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16 page special supplement

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MICROBEE PROGRAM POTPOURRI

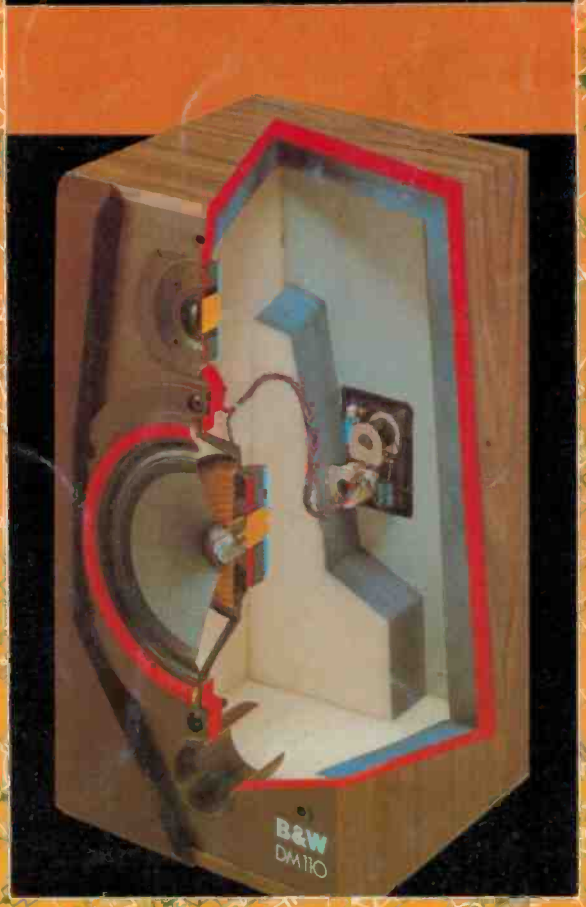
TO BUILD:

Microprocessor bug debugger

For tennis fans electronic 'let' caller

Serial-parallel interface

HI-FI: $399 B&W speakers reviewed

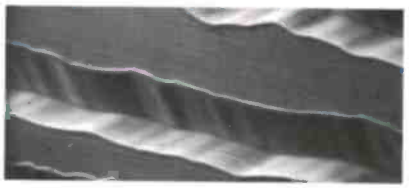


JAPAN AUDIO & ELECTRONICS SHOWS REVIEWED

NOW! ALL-IN-ONE RECORD CLEANER

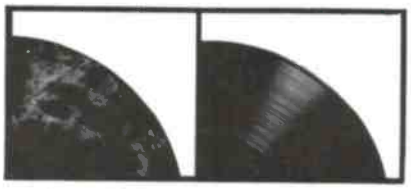
RC5 PLUS™

Made in U.S.A. exclusively for Stanton Magnetics, Inc. Plainview, N.Y. 11803 by Record Care, Inc.



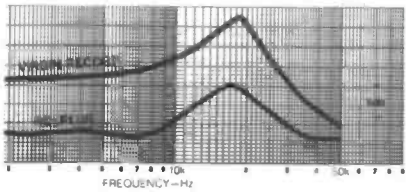
Cleaner

RC5 Plus contains a specially formulated cleaning fluid which safely dissolves oily film, loosens microdust and other debris from the record groove and leaves no residue.



Anti-Static Property

RC5 Plus liquid contains an antistatic ingredient that removes the static charges from a record. The result – clean records stay cleaner because dust is not attracted to the record surface.



Noise Reduction

The result of the above two features allows for a quieter record as measured by the Real Time Analyzer. Even a virgin record fresh from the sleeve can be quieted by the application of RC5 Plus.

"Polarized" Brush and Conductive Handle

The RC5 specially designed brush is directional for best dust debris removal. The conductive handle aids in drawing static charges away from the record. RC5 properly used cleans 150 records, both sides.

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SPECIFICATIONS

Frequency response:	High-level input: 15Hz-130 kHz, +0, −1 db Low-level input — conforms to RIAA equalisation, ±0.2 dB
Distortion:	1kHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N noise:	High-level input, master full, with respect to 300 mV input signal at full output (1.2V): >92 dB flat >100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input, 50 ohm source resistance connected: >86 dB flat >92 dB A-weighted. MC input, master full, with respect to full output (1.2V) and 200 μV input signal: >71 dB flat >75 dB A-weighted.

POWER AMPLIFIER

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Please note that the "Superb Quality" Heatsink for the power amp was designed and developed by Rod Irving Electronics and is being supplied to other kit suppliers. This product cost $1,200 to develop so that your amplifier kit would have a professional finish as well as sound. We also have a new range of rack mounting boxes which will be released soon.

SPECIFICATIONS

Power output:	100W RMS into 8 ohms (± 55 V supply).
Frequency response:	8 Hz to 20 kHz, +0−0.4 dB 2.8-Hz to 65 kHz, +0−3 dB. NOTE: These figures are determined solely by passive filters.
Input sensitivity:	1V RMS for 100W output.
Hum:	−100dB below full output (flat).
Noise:	−116 dB below full output (flat, 20 kHz bandwidth).
2nd harmonic distortion:	<0.001% at 1 kHz (0.0007% on prototypes) at 100 W output using a ± 56 V supply rated at 4 A continuous. <0.003% at 10 kHz and 100 W.
3rd harmonic distortion:	<0.0003% for all frequencies less than 10 kHz and all powers below clipping.
Total harmonic distortion:	Determined by 2nd harmonic distortion (see above).
Intermodulation distortion:	<0.003% at 100 W. (50 Hz and 7 kHz mixed 4:1).
Stability:	Unconditional

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THIRD OCTAVE GRAPHIC EQUALIZER

Over 200 sold

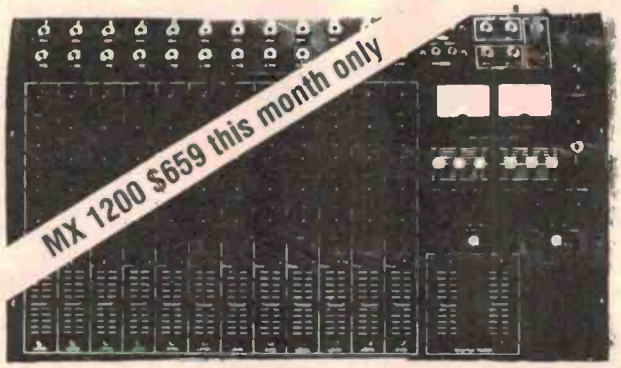
SPECIFICATIONS E.T.I. Dec. 1982

Bands:	28 Bands from 31.5 Hz to 16 kHz
Noise: 20 kHz bandwidth	<0.008 mV, sliders at 0, gain at 0 (−102 dB).
Distortion:	0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.
Frequency Response:	12 Hz-105 kHz, +0, −1 dB, all controls flat.
Boost & Cut:	14 dB

1 unit $195
2 units $379
Assembled & Tested $325

MX-1200 MICROPHONE/AUDIO MIXER

Over 100 sold



XMAS SPECIAL $659

RRP $759

This unit features: 12 microphone line inputs with pan, bass, treble, effect and fold back controls for each channel • LED peak indicators for each channel • 2 turntable inputs with cross-fade and individual output controls • master equaliser for bass, midrange and treble • variable headphone output etc. etc. • complete with carrying case.

SPECIFICATIONS:
INPUTS
Level/Impedance Mic .46 db/1K
Line .22 db/16K = 12
Phono .52 db/50K STEREO = 2 (2mv) at 1KHz
Effect Return (Aux) .20 db/50K = 1
OUTPUTS
Level/Impedance L & R 0 db/2K
Effect Send 0 db/2K F/B Out 0 db/2K
Head phone Stereo +10 db/600 (100 .1K)
EQUALISATION
Channel
Bass ±15db
Treble ±15db
Master
Bass ±12db
Treble ±10db
Middle ±12db

FADER & CONTROLLERS
12 channel fader: Slide, 60mm, LOG 25%
2 Master fader: Slider, 60mm, LOG 15%
12 F/B Volume, 300, LIN
1 F/B Master level, 300, LIN
12 Effect Send, 300, LIN
1 Effect Return, 300, LOG 15%
2 Phono; 300; LOG 15%
1 Head Phone, 300, LOG 15%
S/N, 58DB
FREQUENCY RESPONSE 20-20 KHz
TOTAL HARMONIC DISTORTION: Less than 0.1%
METER: 2 illuminated VU Meters 0db = 0.775V
PEAK INDICATOR: 12 LED Peak Indicators
VOLTAGE: 240 VAL 50Hz
POWER CONSUMPTION: 7.2 watts
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

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KIT PRICE $299 P&P $8.00

- 1% Metal Film Resistors are used where possible
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- Over 200 Kits now sold
- We have built this unit and so know what needs to go into every kit
- SUPER FINISH Front panel supplied with every kit at no extra cost to you
- We are so confident of this kit that we can now offer it assembled and tested so that people who do not have the time can appreciate the sound that this amplifier puts out. This is done on a per order basis delivery approx. two weeks after placement.

only $425

All parts available separately for both kits.

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KIT PRICE $259 P&P $8.00

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- English "Lorlin" Switches are supplied no substitutes as others supply
- We have built and tested this unit and so know what needs to go into every kit
- Specially imported black anodised aluminium knobs
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ADVERTISERS' INDEX

COMMENT

Roger Harrison — Editor

I RECENTLY ATTENDED a 'Communications Summit' in Canberra, organised by the Department of Communications. The theme of this conference was "Australia's Communications — where now?". From that, I expected an examination of our current 'position' with regard to communications in this country and some forecasts of what may lie ahead. I got something quite different.

The Minister for Communications, Mr Michael Duffy, opened the conference with a flurry of announcements with regard to Aussat and gave something of a 'serve' to the broadcasting industry with regard to sports programming. I rather thought we would be hearing discussing, the *form* and not the *content* of our communications industry and policies. But, hobby horses pop up in the most unexpected places, and generally leave unwelcome messages. Fortunately, Mr Duffy's comment was largely treated with ignore.

The eight papers presented over the two days covered the questions of community pressure on policy development, the issue of UHF TV channel spacing, the growth of technology, regulation, engineering and social pressure, and our role vis-a-vis developing countries. In the main, the papers were well researched and panel discussions lively and enlightening. However, I came to the view that they were all essentially standing in the 'here and now' and looking backwards. It reminded me of Spike Milligan's song *I'm Walking Backwards For Christmas*.

About the only speaker to seriously address the question in the conference's title was Barry Mansfield, Federal Secretary of the Australian Telecommunications Employees Association. He was the after-dinner speaker at the conference dinner, and could only address himself to some aspects of the broad question and urged support of the Government's commitment to a public monopoly telecommunications network.

I think the question needs further airing and I hope we can address it in issues to come.

I trust you have all survived the festive season and wish you all the best for a prosperous year ahead.

One of the greatest pains to human nature is the pain of a new idea.

— Walter Bagehot

NEXT MONTH

MICROBEE 'CHATTERBOX'

Can your Microbee say "Owen Hill has laryngitis"? We'll bet it can't even say "bother!". Here's another Tom Moffat ripperbewdysport project for the 'Bee bugs. Based on the SC-01 voice synthesiser, it runs from the parallel port, requires four ICs, two transistors, a loudspeaker and little else. Not expensive either.

RELAYS

They're simple electromechanical devices, aren't they? No. Electromechanical, yes, simple? — no! If you thought you knew all there was to know about relays, this feature will probably teach you as much again. Relay technology is like nostalgia — it ain't what it used to be. If you knew little or nothing about relays before — this will keep you right up to the moment. Don't miss it.

DAMN FAST NiCAD CHARGER

If you really have to charge NiCads in a hurry — this project is for you. A radio-controlled model can go through dry batteries disappointingly fast and photo flashes always run out of flash at the most inopportune moment. This project will get them back 'on the air' in quick time.

THREE MORE CD PLAYERS REVIEWED

Louis Challis continues reviewing examples of the rash of new CD players currently storming the market — from Philips, Technics and Marantz. There could be some interesting results here.

Although these articles are in an advanced state of preparation, circumstances may affect the final content. However, we will make every attempt to include all features mentioned here.

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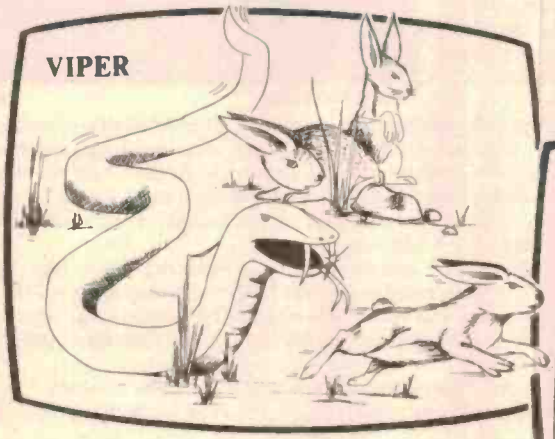
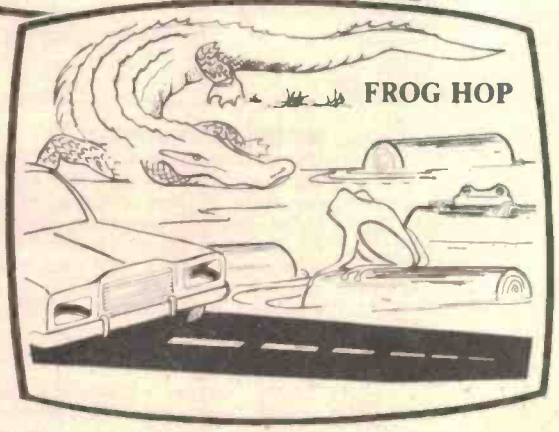
DYNAMIC SOFTWARE

New for '84





- EDUCATIONAL
- UTILITY
- GAMES

VIPER
A highly addictive game. You must eradicate the rabbits before they reach plague proportions but each time you catch a rabbit your tail grows.
Cassette $14.95 . . . . . Diskette $19.95

BEE MONOPOLY
Now a full graphic version of the old family game of the same name. The entire board, players, Community Chest and Chance cards are displayed as required in this fast moving game. Full details of land ownership and finances. Superb graphics and sound effects. (Requires 32K).
Cassette $14.95 . . . . . Diskette $19.95

SWORD QUEST
Just like the 'Dungeons and Dragons' series. Select your characters level of armour, weapons, strength and skill. Explore in search of treasure and the Great Sword, and battle with the dungeon's creatures.
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FROG HOP
A most graphic variation of the popular arcade game. You must hop across a busy street (watch out for the trucks . . .) and across a crocodile infested stream before your frogs are safely home. Guaranteed to appeal to all ages.
Cassette $14.95 . . . . . Diskette $19.95

NOW AVAILABLE ON CASSETTE OR DISKETTE

MANY HAVE JOYSTICK CONTROL & COLOUR OPTIONS

ROBOT MAN '84
Now one of the most popular games ever written for the microbee has been rewritten with new twists, a joystick and colour option.
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New update of one of the original microbee games. Now with full colour and joystick option. Sound and speed controls. Turn your microbee into a home arcade machine.
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SCRAMBLER
A full colour version of the popular arcade game. You are the sole surviving defender of earth and you must destroy the aliens at all cost . . . very effective colour graphics (also suitable for non colour microbees).
Cassette $14.95 ..... Diskette $19.95

EYE OF MIN
A graphic adventure game that will absorb you for hours. If you can solve this excellent mystery then you can proceed to the next saga 'Sabre of Sultan'. (Requires 32K).
Cassette $14.95 ..... Diskette $19.95

ELECTRONIC HOBBY MATE
A real first. This clever program deals with resistors, capacitors, electronic terms and contains a wealth of 'live' information. A must for all experimenters. Your microbee will become a useful design aid.
Cassette $14.95 ..... Diskette $19.95

TUTORIAL: Touch Typing Tutor and Basic Tricks. The microbee is an ideal educational computer recommended by educational authorities across Australia. This package enables you to learn to touch type using the Pitman touch typing method. For those who want to master Microworld Basic there is a series of hints and suggested subroutines arranged in a most effective menu driven style.
Cassette $14.95 ..... Diskette $19.95

RING OF DOOM
Your quest is to search for the Dark Lord of Saurean's Ring of Power. This action adventure game will operate in a 16k microbee.
Cassette $14.95 ..... Diskette $19.95

SKETCH PAD
Use the high resolution graphics in your microbee with this most effective drawing aid. Ideal as an introduction to Cad techniques and you can create complex shapes with a little practice. You can also 'trace' from images taped onto the screen to generate faithful reproductions. Have you ever wondered how programmers create the graphics for their software?
Cassette $14.95 ..... Diskette $19.95

CHOPPER PILOT
Fly your helicopter through a small city and a series of mazes without crashing into the scenery. Has a training mode as well as the real thing for those who want to practice first. Now with joystick option.
Cassette $19.95 ..... Diskette $19.95

GENIUS AND INSANITY
Yes, those insanity blocks are back! The game has several levels of difficulty but really serves as a vivid demonstration of the microbee colour graphic capability.
Cassette $14.95 ..... Diskette $19.95

CHESS/CHESS TUTOR
For those who enjoy a serious graphics game it is hard to beat Chess. If your game needs improving try the tutorial first. You can select from 6 levels of play and these can be altered during the game. This program features very good graphics and, particularly at the higher play levels, becomes a most worthy opponent. (32k microbee recommended).
Cassette $14.95 ..... Diskette $19.95

TARGET/TREK
These are two of the 'classics' of computer games and will still impress with the use of characters to emulate graphics (remember they only had teletypes on the 'old' days around 1976). The challenge of Trek will attract even the most ardent 'anti games freaks'.
Cassette $14.95 ..... Diskette $19.95

LEARNING CAN 'BEE' FUN
Now the full series by John Grimley in one value package containing 6 cassette tapes (or 1 diskette). Utilizing well known games such as 'Donkey Kong', 'Frog Hop' and 'Rescue' you can enjoy the game and learn at the same time.
Cassette Library Pack $49.95
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WORD ADVENTURE
A powerful and gripping educational program. Follow the trails by solving problems involving homonyms, synonyms and antonyms. Various creatures will meet you along the trails and give you clues to the words you seek. If you make too many errors you will certainly have to face the spelling serpent who will test your fate. Once you master the first game you will learn a password which will enable you to load the next secret program. (Requires 32K).
Cassette $14.95 ..... Diskette $19.95

'BEE' CASINO
Another value package with a collection of all the popular gambling/casino games written for the microbee. No need to take the wife to Las Vegas or Wrest Point! This makes ideal party material for after the kids go to bed.
Cassette Library Pack $39.95
Diskette $39.95

BEE SCIENTIST: Physics and Chemistry Laboratory. A collection of practical experiments and courses on physics and chemistry. You can study chemical equations, valency, Kepplers laws, Coulombs Laws and Millikan's experiment. A valuable teaching aid now used in schools.
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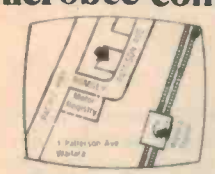
microbee computer shops



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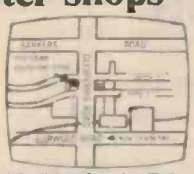

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microbee

DOES THE FUTURE LIE WITH VLSI?

Australian engineers have the resources and skills to play a leading role in microelectronics systems engineering. At a time when talk of new high technology enterprises is very much in the air, it is now that innovative engineers can develop new products based on the new approach to silicon engineering, say Prof. Graham Rigby and Dr Kamran Eshraghian.

Prof. Rigby of the University of NSW, and Dr Kamran Eshraghian of the University of Adelaide, were speaking at a national series of seminars sponsored by The Institution of Engineers, entitled 'Silicon Systems Engineering'.

Very Large Scale Integration (VLSI) is a term used to describe a new technology capable of placing thousands, and possibly millions of devices on a single silicon chip.

The ability to create large systems on a single chip will have a significant impact on numerous disciplines such as engineering, science, medicine and medical care, communication and transportation.

The impact of this technology revolution can be likened to the one that the engine has had on society over the last one hundred years. If engines can be considered as an extension of human muscular power, then in a similar way, the VLSI technology can be viewed as the extension of human mental capabilities.

As the teaching and practice of VLSI spread in the United States and Europe, Australian research groups took up the ideas with energy and enthusiasm. CSIRO launched its multi project chip (MPC) program in 1981 and several of Australia's leading Universities and Institutes of Technology launched courses and research programs in VLSI.

For example, research is currently being conducted at the University of Adelaide towards the development of 200 000 transistor silicon chip for signal processing.

In the seminar, Rigby explained that most of the high-performance modern technologies — both bipolar and MOS could be exploited for VLSI design. But two were of special significance: NMOS and CMOS. NMOS has become the mainstream technology for microprocessors and memories.

Advances in technology have reduced linewidths down nearly to the one micrometre level. The result is that gate delays of the order of one nanosecond are being achieved and this technology is competing with bipolars for high speed logic.

The silicon-gate process used for NMOS makes chip layout simple, compared with older technologies, and this has made it the prime medium for VLSI design.

Both Eshraghian and Rigby believe, however, that complementary MOS (CMOS) will emérge as a more important technology for future VLSI systems. Its lower power and simplified electrical design rules make it particularly attractive.

In reviewing Australia's position in the silicon chip business, Rigby pointed out that there are two chip producers and numerous CAD research groups.

These, he believes, can provide the capability to put a new silicon deisgn into production. This is vital if the new VLSI skills are to become a commercially signficant force. But be warned that there is a difference between a prototype chip and a product.

The production engineering costs involved in making this transition are a significant part of total project costs, but they can be minimised if designers make use of design modules which have been fully characterised and make thorough use of the simulation tools which are available in modern CAD systems.

For further information, contact **Prof. Graham Rigby, Director, Joint Microelectronics Research Centre, University of NSW (02)663-0351** or **Dr Kamran Eshraghian, Senior Lecturer, Department of Electrical and Electronic Engineering, University of Adelaide. (08)228-5333.**

RSTV PROPOSALS

The Minister for Communications, Mr Michael Duffy, said he would be inviting proposals from both private enterprise and the ABC for the provision of radiated subscription television (RSTV) services in Australia.

Mr Duffy said it was important to note that the Government had yet to make decisions on whether RSTV was to be introduced.

RSTV is a service which typically provides programs such as recently released feature films to home subscribers for a fee. Subscribers receive transmissions over the air through a special decoder attached to their television sets. Usually they pay a monthly fee for the service.

"We have confirmed our belief that cable television cannot be justified at this time. However, RSTV could be a different matter. It is less capital intensive than cable and is able to be transmitted using existing technology," the minister said.

AUSTRALIAN TELECOMMUNICATIONS TECHNOLOGY FOR UK

British Telecom have chosen to install Australian designed call forwarding equipment in telephone exchanges throughout Britain.

Austas Communications introduced their microprocessor controlled call forwarding equipment to British Telecom in 1980 and appointed Dynamic Logic of Bracknell, UK, as licensed manufacturers for the UK and Europe.

Following the evaluation of similar equipment from a number of manufacturers and field trials of several hundred Austas units, British Telecom have now placed an initial order with the UK licensee amounting to over A$3 000 000.

Call forwarding is a system which enables incoming telephone calls to be automatically re-directed to an alternate number, without the caller being aware that a re-direction is taking place.

The Austas desk-mounted Divert-A-Call unit is installed in over 5 000 locations throughout Australia, whilst the unit developed for British Telecom is exchange mounted, and the customer may remotely control its functions from any telephone.

Austas Communications is a national Australian owned company largely known for its telephone answering and message processing services, but has in recent years also established an on-going department for the development of specialised telecommunications equipment.

For further information, contact **Ken Webster, Austas Communications Pty Ltd, 1-15 Little Collins St, Melbourne Vic 3000. (03)63-9363.**

BOB TAYLOR

It is with great sadness and an infinite sense of loss that we report the untimely death of ETI's advertising sales manager, Bob Taylor.

Bob was just 40. The tragic car accident that took his life happened on Thursday 15th December — just a few days after his birthday.

He had lunched with my wife and me that day, enthusing, as always, about the myriad of activities that filled his life.

And there were many — for Bob did more things in a year than most do in their lifetimes.

He spoke of hang gliding, wind surfing, jet skiing, selling advertising, motor cycle racing, of his cherished companion Virginia, and of his friends.

Bob came to ETI early in 1976, having worked previously for Thomson Publications. He became sales manager shortly after, and group sales manager a year or so later.

In those seven or so years Bob built up a rapport and mutual friendship with colleagues and clients alike which must be without parallel in our industry.

Bob was somehow so much larger than life that it's all but impossible to accept that he has gone.

As Saint-Exupery wrote, in The Wisdom of the Sands, "He who has gone, so we but cherish his memory, abides with us, more potent, nay, more present, than the living man."

Our sympathy goes out to Virginia, his parents, sisters, son Matthew, and his especial friends, including John, Mac, Roger, Sean, Jan, and Jenny. He was my friend too.

Collyn Rivers

APOLOGY

Pro-Log (Australia) Pty Ltd apologises for an error in their advertisement in ETI, December 1983. It should have read "and purchase 250 of any of our boards and the manufacturing rights to that board are yours".

POLICE RADAR IS STILL FALLIBLE

In March 1981, ETI published an article which exposed the fallibility of police radar units, discussing three different possibilities of failure.

The Standards Association of Australia has now begun preparation for an Australian standard for radar speed detection equipment and a code of practice for its correct use.

The decision to proceed with the project was taken following discussions between the SAA and representatives of state police departments, road user groups, expert technical bodies and radar equipment manufacturers.

During the talks, the representative of the Australian Automobile Association, Mr Joe Kenny, expressed his organisation's concern that tests showed that some radar speed guns were capable of measuring the speed of any vehicle within an arc of up to 60° from the point at which they were aimed.

The ETI article pointed out two other possibilities for error, even though they are both very rare. Briefly, one type of failure may arise because the unit pays no heed to the constancy of the mark to space ratio of the pulses within an averaging period. A particular situation could occur which would lead to an erroneous measurement. However, the probability of such a situation remaining stable long enough to take a reading is extremely small.

The other possible error results from the mixing function used to derive the audio tone. The rare situation arising which would allow any failure here is virtually only possible in a certain type of unit.

Most importantly, the method of using the unit determines its reliability. At this stage different police forces use different methods of training.

Overall, the meeting expressed the view that an Australian standard for radar and a code of practice for the use of the equipment would remove those areas of uncertainty which had created doubts amongst the nation's motorists about the accuracy of readings taken by these devices.

NATIONAL COMPUTER CENTRE FOR HOBART

The Deputy Director of Britain's National Computing Centre, Mr Eric Howe, is conducting a feasibility study into a proposal that Hobart should become the technological research and training centre for developing Australia's computer industry.

The study was announced by the Tasmanian Premier, Mr Robin Gray, after talks with the Department of Industrial Development and David Fairbairn, Director of the National Computing Centre, which has its headquarters in Manchester, England.

The UK National Computing Centre was established by the British government. It is now independent and has set standards and devised training schemes for Britain's computer industry. Some of these have been adopted worldwide.

Tasmania has succeeded in taking the proposal to the feasibility study stage because it persisted in its attempts to establish a high-technology base in the State and because a computer centre needed to maintain its independence of national government and the larger population centres.

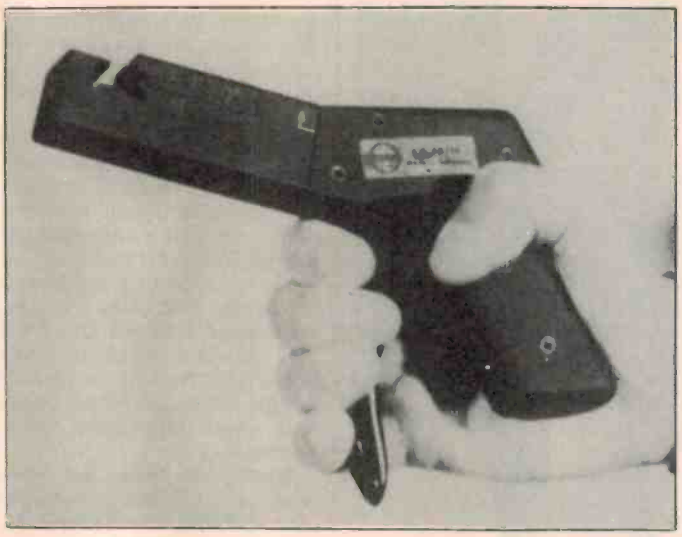
SELF-INDEXING WIRE TERMINATOR HAND GUN

Molex has released a self-indexing, hand held wire terminator for the insertion of discrete wires into Molex insulation displacement connectors.

It features snap-on modular dies for termination of wires on 2.5 mm, 2.45 mm, 3.96 mm, 5.0 mm and 5.08 mm centreline Molex connectors. A module is available to terminate 1.27 mm ribbon cable to the MX 50 connector.

A pneumatic bench terminator with foot pedal and a filter for the air supply line is also available for all modular dies except the MX 50 insert.

For further information contact **Utilux Pty Ltd, 14 Commercial Rd, Kingsgrove NSW (02)50-0155.**



AUTOMACH AUSTRALIA

Prime Minister Hawke has endorsed Automach Australia 84, Australia's first high-technology conference and exhibition to be held at the Royal Hall of Industries in Sydney, May 23-25 1984.

The purpose of the three-day event is to stimulate the use of integrated manufacturing systems by Australian industry, leading to improved productivity.

The high-tech event is sponsored by the Society of Manufacturing Engineers, its Australasian chapters and two constituent associations of SME, Robotics International and the Computer and Automated Systems Association.

In addition, Automach is supported by Australia's leading engineering and industrial associations and academia, SME said.

Mr Barry Jones, Minister for Science and Technology, will deliver the keynote address at Automach Australia on May 23.

Mr Neville Wran, Premier of New South Wales, will formally open the exhibition and participate in the opening press conference with SME officials.

More than half of the exhibit space at the Royal Hall of Industries already has been assigned, said Adolf Greco, chairman of SME's Australasian chapter and chairman of Automach.

These exhibitors include Computervision, IBM, Prime Computer, Hewlett Packard, Perkin-Elmer, ESEA, Zenford-Ziegler, Ferrocast Williams, Management Information Services, Javelin Electronics, Sandvik, Ceanet and Jordan Computers.

To date, these exhibits represent the manufacturing equipment, systems and services of more than 70 companies from over 10 countries, Greco said, adding that a wide range of numerically-controlled machinery, CAD/CAM, robotics, software, tooling and accessories, and computer-based equipment will be demonstrated.

For further information contact **A. Greco & Associates, 3/D Tyrone, 80 Shirley Rd, Wollstonecraft NSW 2065. (02)439-4014.**

AID FOR THE AGED

In 1979 in Victoria alone, 379 people over 55 years of age died as a direct result of accidental falls. In many cases the panic arising from the situation is likely to have been a major contributing factor.

Norman Wiggett has set up a company, HAETAS Australia Pty Ltd to manufacture and market his projects designed to help the aged and disabled. One of these, the Emergency Call Service and Library, operates a low cost, 24 hours a day, automatic telephone monitoring system — in the event of an emergency, help is just the press of a button away.

Users carry a compact, lightweight, unobtrusive transmitter which will activate the telephone to call the monitoring service, who will immediately summon help from nominated friends, neighbours, relations, or if necessary, the police.

Once initial funding is available, the Emergency Call Service and Library will for formally established as a non profit, community based organization in each state. Those who cannot pay for the service receive it free. The manufacturer, HAETAS, will continue to make and service the units, selling them exclusively to the Emergency Call Service and Library on a non profit basis. The current cost per unit is $299.

HAETAS will also provide the 24 hour monitoring service under contract to the Emergency Call Service and Library. The monitoring cost is $1.50 per unit per week. Mr Wiggett is looking for more ideas for aids to the aged and disabled, and is also looking for a source of good cheap components.

"Once we have supplied the Australian market with our service, we have nineteen other countries interested in this project and our export could be in the billions of collars worth of electronic equipment that can be produced in Australia," he says.

For further information, contact **HAETAS Australia Pty Ltd, P.O. Box 220, Bayswater Vic 3153. (03)725-7095.**

COMX35

SPECIAL OFFER!

ONLY $239 FOR 35K RAM
HALF PRICE COMPARED WITH OTHER COMPUTERS

Built-in BASIC

also available:
FORTH & PASCAL (Optional)

REMEMBER!

You may have to spend a couple of hundred dollars on other computers to expand to such memory size, and their software. If you move quickly you won't miss the chance to own this amazing computer with features not even found on the $499 machines. COMX 35 computer has 35,000 characters memory (7-10 times more than some other popular computers), expandable to 67K, with built-in joystick, speaker, colour graphic, editor, and can use most ordinary cassette tapes, recorder, and home TV.

SPECIAL OFFER!

COMX 35 computer: ~~$299~~
SPECIAL: $239
It comes with 35 KB RAM, joystick, "An Introduction to BASIC Programing manual, AC adaptor and connecting leads.

12"Green Monitor: ~~$250~~
SPECIAL: $220

PACKAGE A, comprises of:

• COMX 35 computer	$299
• 20 Programs	$203
Regular	~~$502~~
SPECIAL	$299

PACKAGE B, comprises of:

• COMX 35 computer	$299
• 20 Programs	$203
• Datacassette recorder	$ 60
• Deluxe COMX carry case	$ 50
Regular	~~$612~~
SPECIAL	$369

COMX already has a large library of programs for education, personal, household, business and entertainment purposes. COMX is NOT simply a game machine, but uses the internationally recognised COMX "user friendly" BASIC language. FORTH and COMX PASCAL languages are also available for high-speed educational/mathematical programming.

Following are 20 programs for above Packages A or B: (there are 80 other optional programs in a software — list too!):

GAMES (9): Worm — Eat A Plum — Shoot N Run — Othello — Joycard — Reaction Time — Tic Tac Toe — Tower of Hanoi — COMX Chess

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Please allow 10 days for processing of order.

Reflecting obsessions — The Japan Electronics Show

Computer report

Japan gears up to grab a share of the home computer market with Microsoft compatibility, while computerised television and mini robots become even more sophisticated.

Dennis Lingane

THE JAPANESE may have finally come up with a way to break into the booming home computer market. At the Japan Electronics show in Osaka last month, twenty of the leading manufacturers announced they had designed their computers to run Microsoft programs under the logo MSX.

MSX standardization

Microsoft is one of the leading independent software companies in the USA and the decision by multi-national companies such as Sony, Toshiba, Hitachi, National Panasonic, and others, means Microsoft may become the official Japanese software system.

However the three leading computer companies NEC, Sharp and Fujitsu have not agreed to go along with the scheme yet. Their reluctance to join the rest is obvious. They are the three companies that have so far managed to gain overseas acceptance, as well as dominating the Japanese market.

To go along with MSX standardisation would effectively be opening the doors to both Japanese and overseas markets for their competitors.

There is more than enough competition in the market place at the moment.

The MSX-compatible home computers are being launched in the market in time to try and grab a share of the one million home computers expected to be sold in the pre-Christmas period in Japan. All companies with MSX were making a lot of noise about it at the Osaka show which was visited by over 300 000 people.

IBM protects copyright

While MSX may become the standard for Japanese home computers, the policy in the personal computer area (over $1000) is to make the machines IBM compatible. This was done following a recommendation from Japan's MITI (Ministry for International Trade and Industry). But that may now be running into problems following the agreement by Hitachi to let IBM police everything it makes in the next five years to ensure it doesn't breach IBM copyright and patents.

This five year policing of Hitachi products by IBM was part of the out-of-court settlement following the court case in which Hitachi and several of its employees pleaded guilty to stealing and trying to export IBM's trade secrets. Hitachi and Mitsubishi were caught red handed over 12 months ago by the FBI in an undercover 'Sting' operation.

In the settlement, Hitachi agreed to pay all IBM's legal expenses (described by IBM as substantial), to return all IBM secret documents, and to let IBM examine all Hitachi products for five years to make sure they did not contravene IBM patents and copyright.

This has sent the rest of the Japanese manufacturers into panic. They had hoped that Hitachi would fight the case and set a precedent. However, Hitachi was under a court injunction not to sell computers until after the case was settled. It had already

dragged on for over a year and the company was losing out in the market place.

Compatability causes concern

They settled, and in doing so left the question of IBM compatibility open, with the threat of a test case still an issue to worry about; It also gave IBM the opportunity to keep a close eye on what was possible and not possible. In other words, if Hitachi is not able to come up with an IBM compatible machine without contravening IBM patents and copyright, then every IBM compatible machine made must come under suspicion.

If the Japanese do build their personal computer industry on the back of IBM, only to lose a test case in a few years, they could find themselves having to pay huge licence fees and royalties to IBM for the right to be IBM compatible. It's a situation that they had hoped would be resolved by Hitachi. Now it's still an open issue hanging over them as they crank up their production lines to get some of the computer action.

A few days after the settlement, the other manufacturers came back with a counter attack accusing Hitachi of endangering Japanese technology.

They argued that, by agreeing to a five-year policing of Hitachi computers, IBM would be in a position to learn about and copy Japanese computer developments and breakthroughs. Hitachi has denied that Japanese technology would be at risk, and both IBM and Hitachi have agreed to refer disputes to a panel made up of a member of Hitachi, a member of IBM and an independent authority, to make a ruling.

There is no doubt that IBM has pulled off a master stroke. When I visited IBM in New York last year, they told me then that they regard Japanese competition very seriously. It is obvious now just how serious.

Interestingly, Canon announced on the eve of the show they have signed an agreement with Apple to sell Apple computers in Japan, which takes them out of the market battle.

But getting back to the electronics show.

The Sharp PC-5000 portable computer. It has a fold down liquid crystal display, built-in printer, removable bubble memory packs and optional modem.

Mini robots. They were definitely the order of the day at the show as a way of displaying the versatility of the computers.

Computerised TV's

As far as computers are concerned, the Japanese are still selling hype rather than machines. Like electronics magicians, they promote the futuristic aspect of home computers with home monitoring systems and sensor touch TV data selection.

National Panasonic showed a TV set with in-built computer that was menu driven, but instead of a keyboard, you simply touched the TV screen with your finger. The part of the menu you wanted was searched out and displayed. To continue, or abort, you simply touched the words on the screen instead of hitting a key on a typewriter keyboard. It's a good idea but will lead to very grubby TV screens.

I don't know how my son, who tends to lie back on a couch or on his bed with a keyboard on his lap with a three metre cord connecting him to his TV, would react if he had to keep walking to his TV set to search through a menu.

The program they ran was a home control system. So, if you wanted to close the windows, or curtains or turn out the light then you just called up the room, and touched the things you wanted activated. Mind you, by the time you turned on the TV set, loaded the program, found the section, and then touched the section you wanted to activate, it would probably be quicker to walk to the room — unless you live in a mansion.

Talking intelligent TV sets. Sharp says that a TV set without a computer won't be a TV set in coming years. They launched a TV computer system last year that was an instant hit. The TV was designed to display ▶

your computer program over the TV picture. This meant that you could watch a TV program and compute at the same time. It was an instant success with the kids.

Now they have produced a budget version of this computerised TV that is a lot cheaper called the C1, but it has limited applications. Instead of an alpha-numeric keyboard you get a hand controller with a joystick and three buttons. The alphabet is displayed at the bottom on the screen, and you move a cursor to the letters you want and press a button.

A bit more laborious than an alpha-numeric keyboard, but this system does sell for only $100 more than an equivalent TV set. There are ports for a cassette and cartridge. So you can play games, run educational programs for children, or leave messages for other members of the family. The messages are locked into a memory so when the TV set is turned on the message is automatically displayed. There is also an indication light to let you know there is a message in memory anyway.

80 column portable computer

The other magic product Sharp showed at this show was a portable computer with bubble memories, and a fold down liquid crystal screen that will display up to 80 columns wide and eight lines down.

It is a travelling person's dream. The on-board memory is 128K and it has a printer built in. (See illustration). The screen folds down over the keyboard and the whole system is no larger than an average portable typewriter. The printer is dot matrix with thermal as well as ribbon printing. The bubble memory packs are removable and can be used for data storage — each has 128K of memory — the equal of the on-board memory.

It is due for release in Australia in a few months. There is a modem port, as well as disk drive (RS232), but there isn't an outlet for a TV monitor. But with 80 columns and eight lines, Sharp probably figures there isn't a need for a TV monitor. It will be released in Australia in a few months but will be a lot more expensive than the Tandy and NEC machines, which are all we have seen so far as portables with liquid crystal screens. They have 40 column screens however.

Language computer

The other eye catching product at the electronics show was a language computer from Mitsubishi.

This was a sort of sophisticated version of Texas Instruments Speak and Spell. But this not only says the words in very good clear English voice as distinct from the TI Yankee drawl, but showed on a liquid crystal display both the English and Japanese words.

The unit holds up to 750 words and it sells for around $100. Several junior schools have placed orders. One good feature is that you can get the word repeated slowly to enable students to pick up the enunciation. An add-on module is available that expands the unit to 1500 words and 1000 sentences.

While everyone was trying to prove that the idiot box would be running our lives, Toshiba championed the telephone as the way to remote control the home. Pick up the phone, either from outside or inside the house, tell the computer what you want done and it does it. Much quicker, but not as impressive when you have guests you want to show off to.

Robots

The other obsession at this electronics show was robots. Not large industrial ones, but mini ones no bigger than the Action man dolls. These were being run to prove how versatile the computers are. But if these manufacturers really thought about it, they could probably do a lot better making mini robots to run off Apple, Commodore and Atari computers.

One last word on TV screens. NEC is pioneering a new TV tube that will enable you to have a receiver monitor that will handle an 80 column computer.

Currently the holes on TV masks (pixals to computer buffs) are around six microns. This limits the display to around 40 columns because you can't get the resolution. But NEC is now making TV sets in Japan with four micron holes and this enables you to run 80 column computers. Unfortunately it means the TV picture quality drops dramatically. You lose brilliance and contrast. But then you can't have your cake and eat it.●

The Digital vs. Analog battle is over.

From $110 buys you the new champion. **The new Fluke 70 Series.**

They combine digital and analog displays for an unbeatable two-punch combination.

Now, digital users get the extra resolution of a 3200-count LCD display.

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Plus unparalleled operating ease, instant autoranging, 2,000+ hour battery life and a 3-year warranty.

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Each is Fluke-tough to take a beating. American-made, to boot. And priced to be, quite simply, a knockout.

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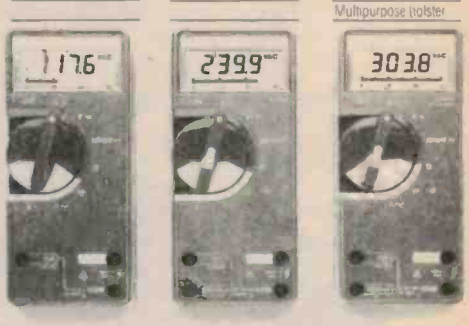

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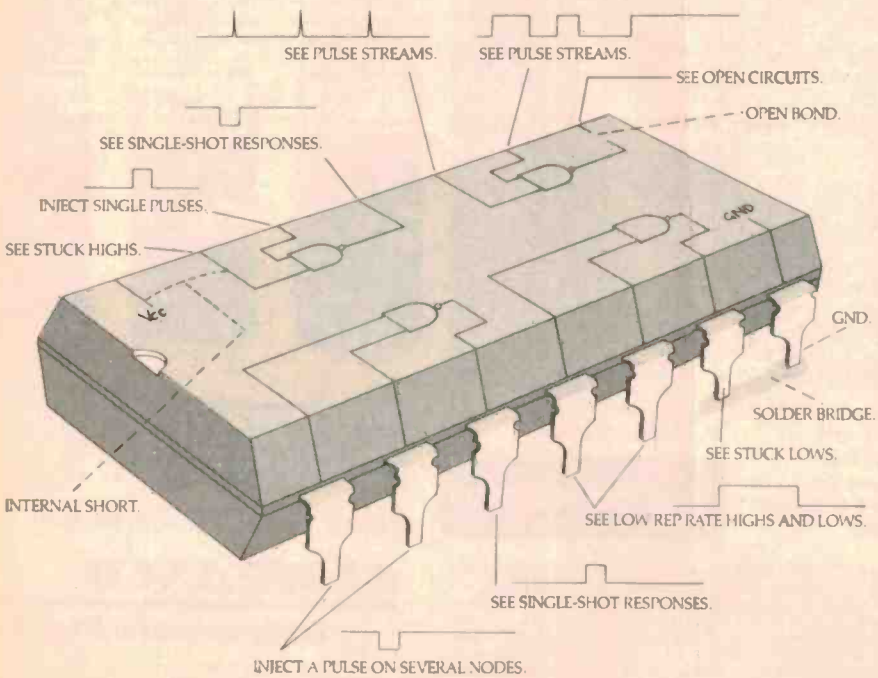

1

The Model 545A Multi-Family Probe. See logic highs, lows, bad levels and open circuits with logic probes. Capture one-shot pulses. See pulse streams.

2

The Model 546A Pulser. Inject a pulse or pulses into a circuit without trace cutting or unsoldering. Automatically drives low nodes high or high nodes low. The Model 546A Logic Pulser creates your programmed number of logic pulses and has multi-family capability.

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3

The kit puts it all together. The HP5024A Kit puts the logic tool kit all together in a convenient carrying case. In addition to the Multi-Family Probe and Pulser, the kit contains the model 547A Current Tracer. The 547A will trace current when you reach a node where the logic probes cannot work because the node is stuck low and you don't know which bus component of many is faulty. No pc board trace cutting or good component removal is necessary.

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OR
Hewlett-Packard Australia Limited,
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MELBOURNE
Federal Publishing Company,
150 Lonsdale St., Melbourne.

BRISBANE
Hewlett-Packard Australia Limited,
10-14 Payne Rd., The Gap.

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LBV 5302 HEP 90367

CHEAP POCKET TV

Arival to the pocket transistor radio has been launched — a cheap pocket TV set. Costing less than A$136 in Britain and under US$100 in the US, the new Sinclair flat-screen pocket TV is being geared for millions of sales worldwide. Sir Clive Sinclair, founder and chairman of UK Sinclair Research Company, said he had plans for a large flat-screen colour TV and a pocket set that will combine TV and radio.

Although Sir Clive claims he produced the first flat-screen TV tube he was narrowly beaten to the market-place with it by a Japanese rival. However, when he unveiled the pocket set in London he announced a price tag of A$135.91 including tax and said it would be sold in the USA for well under US$100. This is said to be less than a third of the price of its rival set.

Sir Clive maintains his 50.8 mm screen set represents a whole series of firsts in technical advances. It is smaller than an average paperback book at 140 x 90 x 30 mm, weighs 280 gm and has only two controls; an on-off/volume switch and a tuner. Its special flat battery provides 15 hours of viewing, up to six times longer than that of its competitors, it is claimed.

Experts have tried for years to reduce the bulky depth of the conventional cathode ray tube. Many have said that once this problem has been solved the family TV pictures will be on something like a picture hanging on the wall. Sir Clive's solution was to send the cathode rays from the side, bending them round to fall on a screen and form a picture.

The tiny Sinclair screen is up to three times as bright as normal and uses between one quarter and one tenth the power of a conventional tube. The screen is recessed to increase brightness and contrast.

Apart from the tube innovations, the new set uses a single integrated circuit which was designed by Sinclair Research in collaboration with the Ferranti electronics company. The set is the first TV set to use just one chip for its circuitry. Sir Clive says the chip, which is subject to a 'flood' of patents, is unique. "Nobody else has anything like it," he added.

The complex chip ensures that most of the set's functions are automatic. The set is designed to handle all 625 and 525 line systems and most UHF transmissions around the world except France. A combined UHF/VHF set will follow later and replace the present UHF set. The chip analyses the incoming signal, automatically decides which line system is being received, and adjusts itself accordingly.

The new TV, which is about to enter full production in Britain, will be available at first by mail order only. The aim is to build up production to a rate of 10 000 a month by the end of this year. After initial sales in the UK, the set will be launched in the US next year and progressively throughout the world; including Japan.

More information about this tiny TV, which has been used successfully in cars and trains, can be obtained from **Sinclair Research Ltd, 25 Willis Road, Cambridge CB1 2AQ England.**

DYNAVECTOR CARTRIDGES

Concept Audio has released two new Dynavector cartridges.

The DV19A has a similar shape and configuration to the DV23R ruby. However, the cantilever is even shorter, 1.9 mm.

Aluminium has been used in the construction of the cantilever, lowering cost and also making the cartridge more resistant to customer abuse. The unit is priced at $248.

The second new cartridge, the DV17DS, features a tapered diamond cantilever, enabling a reduction in the equivalent moving mass of 21% over the current 17D model. This increases tracking abililty at ultra-high frequencies of more than 20 KHz.

A Micro Reach stylus has also been introduced. Its unique shape enables a very wide frequency range, excellent dynamics and low distortion. This unit is priced at $698.

For further details, contact **Concept Audio, 17/98 Old Pittwater Road, Brookvale NSW 2100. (02)938-3700.**

INFRARED TV

Sennheiser's latest infrared television transmitter, the SI406-SY, is designed for television sets which do not have a headphone socket as standard equipment.

The transmitter comes with an angled electret microphone for mounting on the side of the television set, with the microphone itself positioned directly in front of the loudspeaker aperture. This enables it to pick up the full acoustic quality of the sound, says Sennheiser.

The transmitter, which can be mounted without interfering with the interior of the television set, is identical to the long-established SI406-S transmitter. It is ideal for hard-of-hearing applications.

For more details, contact **R. H. Cunningham, 146 Roden Street, West Melbourne Vic. 3003. (03)329-9633.**

GOOD HEAD FROM AKAI

A more portable entertainment centre is the AKAI Bandearo — a new micro-mini 2 band AM/FM stereo headphone receiver.

Engineered with AKAI's "You Can't Miss" concept, the Bandearo uses the latest monolithic chip design to maintain sound reproduction which is usually attributed to full size hi fi systems.

A highly sensitive radio tuner, a whip antenna, a stereo amplifier and a long life power pack integrate perfectly in the slimline head-phones.

The auxilliary jack and the patch cord provided hook up to stereo equipment and the Bandearo can be connected to another set of headphones.

The unit retails for $69. Contact **AKAI, Unit 11, Eden Park, Waterloo Rd, North Ryde NSW 2113. (02)887-2311.**

THE MOBILE COMPACT DISC

Following the highly successful market introduction of the Compact Disc digital audio system during 1983, Philips has displayed a prototype car Compact Disc player at this year's Berlin Funkausstellung audio/video exhibition, held from September 2-11.

It will be particularly welcomed in view of the current demand for in-car sound quality of the same level that is expected in the home.

Other important advantages of the compact disc are significant for in-car use. Its ease of handling and operation will contribute to safety, while the durability and resistance to wear of the 120 mm compact discs make this new medium well suited for mobile use, Philips claims.

The widespread appeal of the compact disc medium may be expected to increase still further as new applications for the system are developed — for example, the areas of high-quality portable and personal audio products.

The prototype in-car compact disc player shown at Berlin is expected to undergo a number of changes before a final production version is reached. Size of the player will be reduced further, to allow it to be positioned as conveniently as possible inside the car.

Special attention will also be given to the disc loading system and disc storage in the car to optimise ease of use, and hence driving safety.

Philips expects that production of a car compact disc player could start within a time span of some two to three years, by which time the Compact Disc system is expected to have reached a high degree of market penetration.

Looking further ahead, the compact disc system should be well suited to some exciting future in-car applications, thanks to its extremely large information-storage capability.

These could include the presentation of route or tourist information, for example, with a single compact disc replacing a number of conventional maps and guide books.

Developments like these will ensure that the system remains at the forefront of attention during the coming years.

For further information contact **Peter Brownlee, Philips Industries Holdings Ltd, North Sydney NSW. (02)925-3333.**

EXTRA HIGH GRADE VHS VIDEO CASSETTES

TDK (AUSTRALIA) Pty Ltd has released its new range of extra high grade VHS video cassettes.

The cassettes feature packaging consisting of a plastic viewcase outer sleeve which protects the cassette much greater than normal cardboard sleeves do.

Since the advent of Super Avilyn material in 1978, this magnetic medium has been the standard to which most of the audio and video industry has related.

The Extra High Grade range of TDK VHS video cassettes employs Super Avilyn magnetic material, however, to improve on the quality of standard cassettes, TDK has also employed a high dispersion and durable binder which spreads the near-microscopic Super Avilyn particles more evenly across the surface of the tape. This binder process holds the particles firmly in a flexible yet very tough film of plastic coating.

This, coupled with improved calendering or polishing of the tape surface to a mirror-finish reduces to an all time low friction and headwear during tape-to-head contact.

Just how much better TDK's Extra High Grade VHS video tape is shown by the following technical specifications: Signal-to-noise ratio is up 3 dB in video, +5 dB in colour, compared to TDK's reference standard; Coercivity stands at 680 Oe, meaning precise response and input/output linearity; Audio frequency response is flatter across the range and offers better fidelity than normal video cassettes.

The recommended retail price of TDK's Extra High Grade VHS video cassettes are: E60 — $16.99, E120 — $19.99, E180 — $23.99.

Detailed specifications are available from **TDK (Australia) Pty Ltd, P.O. Box 100, Pyrmont NSW 2009.**

The All Japan Audio Show Reviewed

In its 32nd year the show reflects the shift towards the merging of sound and video.

NOW in its 32nd year, the All Japan Audio Show is billed as the largest audio show in the world. With 80 companies exhibiting some 6000 products and an attendance of 300 000 people, the claim is beyond dispute. With video hi-fi, video disc, and gadgets for creating visual interpretations of sound on TV sets called audio video synthesisers, the show was more a visual experience this year than an audio one. One can be left in no doubt after seeing this show, that sound without picture will soon belong in the past.

During the previous two weeks touring around Japan visiting various companies, all they had been able to talk about was compact disc, and I walked through the turnstiles into the huge hangar — like buildings at Harumai expecting to be buried in CD technology.

Dennis Lingane

Indeed there were some 40 new CD models compared to only 10 last year. But they were almost lost in the glare of TV sets and video graphics. Every manufacturer had banks of TV sets, and on them was everything from Flashdance, opera and concerts to images from VU meters and real time graphic analysers. However, most of the new products were really only revamped old products with a new facia or a different colour. The Japanese are mad on colour these days, and we are already seeing the trend in Australia, in the portable market where fashion colours are all the rage.

Nakamichi reverse

In the pure hi-hi arena Nakamichi and other traditionalists had some new audio products to show. Nakamichi unveiled a budget version of its TX 1000 computer controlled turntable, the Dragon CT, and a reverse play cassette deck called RX202.

The reverse play raised a few eyebrows, because it is generally accepted that you can't get the same sound quality from a reverse play cassette deck as you can from a conventional one-way system.

But Nakamichi has overcome that problem by building a revolving platform on the front of the cassette deck. The cassette deck has conventional mechanics, and the cassette is physically turned around. Effectively the RX202 does mechanically what we do manually.

The budget version of its now famous TX 1000 computer controller analogue record is far from budget, since it's priced in the multi-thousand dollar range. The main purpose of both turntables is to compensate for poor record production. Nakamichi says that very few records are cast with the hole dead in the centre, and this creates wow when the record is played.

Both these turntables measure how far off axis the record spins, and then adjust the platter to achieve a perfect rotational axis. The more expensive TX 1000 does this electronically using a computer. In the Dragon CT the measurements are done by the microcomputer but the adjustment is done mechanically. It's still an impressive looking turntable.

Nakamichi fans will be relieved to know that he is now working on a CD player.

Banks of TV sets. Video hi-fi video disc and video synthesisers were very prominent at the show, indicating the trend towards a complete merger of audio and video.

◀ **The 'budget' computer turntable.** The Dragon CT does away with wow with computer measurement and mechanical adjustment.

Budget CD

Currently, (except for Sony) the whole thrust of the Japanese CD production is to the budget market. The name of the game is to get production up and prices down. Technics and Yamaha are leading in this campaign with price points of around $500 in Japan.

But while they pursue this course, they are losing the support of the audio 'maniac' as audiophiles are called in Japan. The elitists are giving CD a big miss.

Sony is the only company that is looking after the needs of the audio maniac with the CDP 701 player which has separate digital to analogue converters for each channel. This machine costs almost $2000 here in Australia and does have a demonstrably better mid range than the popular CDP 101.

Getting back to the Japan Audio Show — virtually all these second generation players are now drawer-loading systems like the Sony/Philips/Marantz. Philips says that the Japanese have found that this is the best way to have a disc spinning because the centre of gravity is working with the disc to create stability. Something Sony and Philips knew from the start.

But all Japanese companies I spoke to denied this was the reason they had shifted to drawer-loading.

They said they adopted the front-loading drawer system because it was slimmer and fitted in better with current hi-fi systems.

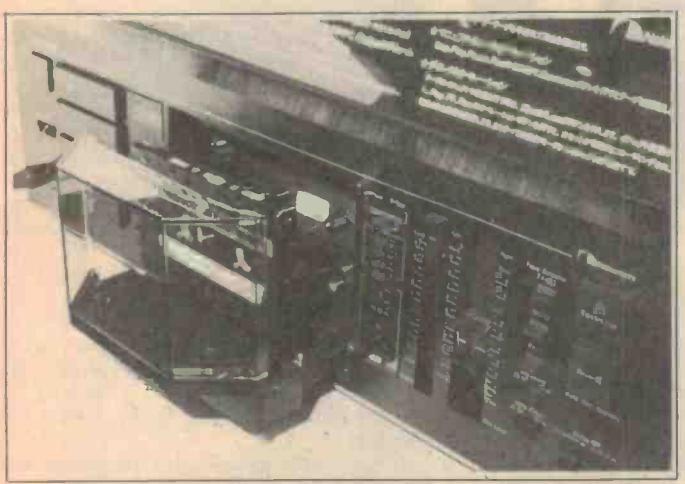
Whatever the reason, nearly every new model demonstrated at the show had front drawer loading, thus probably setting the industry standard.

Cars and the CD

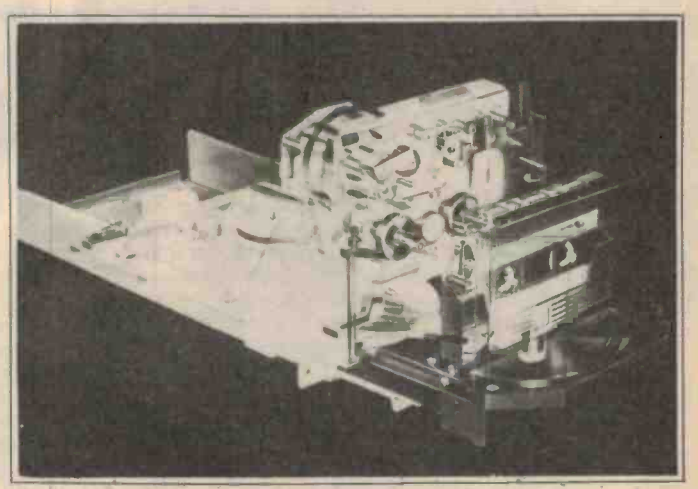
There were one or two car digital disc players demonstrated but according to all information sources this is unlikely to become a reality for years.

The vibrations in a car are a major problem. But even if they bend all their expertise to beat the vibrations, the discs present another problem that looks unbeatable.

The discs warp at around 60°C and the heat in cars in Australia often gets up around 105°C. So the practicality of putting a player in a car is questionable. We are likely to see it incorporated in portables before we see it in a car, says Sony. ▶

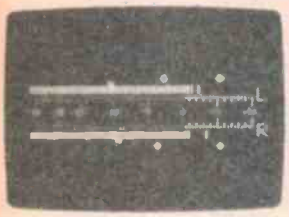


The revolving platform. The Nakamichi reverse play physically spins the cassette around and replaces it in the machine.

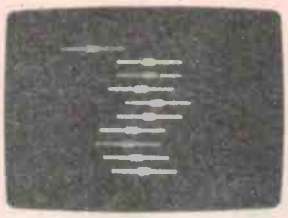


The mechanics. A view showing internal detail.

The All Japan Audio Show

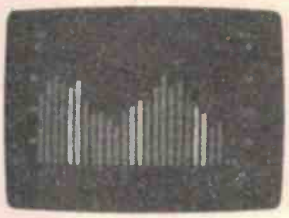


Peak/VU level

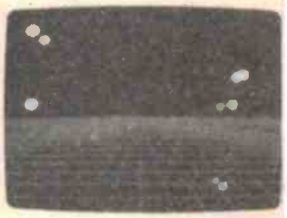


Sound image

Musical scaling



Spectrum analyser



Sound space

The CD juke box

Denon showed a professional CD juke box that holds around 100 discs and will sell for about the price of one of the more expensive traditional juke boxes.

Technics was rumored to unveil a home juke box at the show that would hold about 10 discs and could be programmed to play any tracks off any discs. But it didn't appear and a spokesman for Technics says that it wasn't ready for the show and is still under development.

Technics is one of the companies to watch over the next year or so in the CD race. A late starter, they are pouring on the pressure to catch up with the leaders Sony, Marantz and Philips. Technics has a brand new five story building in Osaka dedicated to CD development and technology. On the top floor an army of scientists (around 150 would you believe) work with computers designing chips and components for the CD era.

On the next floor they have production lines for the laser diodes, and also a plant capable of producing 200 000 compact discs a month.

Technics produces all the Telarc and A & M discs, and are looking for contracts from many of the leading record companies. They are producing around 100 000 a month currently, and plan to crank the system up to full capacity in the next six months.

The main production lines occupy two other floors. Plastic powder is delivered to the front door and emerges at the back door as a CD player, boxed up ready for shipping.

So expect to see a very aggressive approach to marketing CD players from Technics over the next couple of years. There is a good reason for their interest in CD. They currently have around 30% of the world turntable market and if CD is going to take over from traditional turntables they will want to be in the box seat to make sure they don't lose the business.

Video hi-fi

But while CD is important at the audio show, the biggest area of interest was video hi-fi. These new video machines give audiophiles and videophiles super high quality audio.

Sound with pictures. JVC's audio video graphic synthesiser has an impressive variety of ways to represent sound graphically, as the illustrations above show.

The dynamic range is claimed to be around 90 dB, and frequency response 20-20 000 Hz. These machines have already taken 20% of video turnover in Japan and look long term as if they will replace all current video recorders in the $800 and over price bracket.

But while the main purpose of video hi-fi is to be a video recorder, over 40% of these machines bought are not connected to a TV set. They are bought by audiophiles who use them simply as an audio recorder because they are the only analogue system capable of recording CD.

These allow the mix of multi video and audio systems and incorporate sound enhancers as well as video intensifiers.

The video sound processors basically have a noise reducer at 14 kHz, a five-band graphic equaliser, two-band expander, stereo processor for mono recorders, mike mixing, and audio mixing.

Sound and picture

My favorite gadget of the whole lot was JVC's video graphic analyser. This black box will sell for around $399 in Japan when released this month. It monitors the audio signal from your hi-fi set and turns it into graphic pictures on your TV set. There are five modes in this JVC unit. The first is a real time spectrum analyser so you can sit back and watch your music translated into a graphic. Or by a flick of a switch it can be turned into colourful VU meters.

These functions, JVC argues, have practical applications for audio enthusiasts who can use them for monitoring performance in recording and replay. But the rest are pure entertainment. One of the modes creates a space trip to music. Even the meteors rocketing past your space ship do so in time to the music.

There are weird shapes that expand sideways in time to the music, or you can have the music translated into a musical score with the notes dancing onto the screen as the music plays. Very educational, argues JVC. I thought it was great fun and fills the missing link in the audio video marriage.

Eventually, compact discs will have some sort of illustrations incorporated on the discs. There is enough room for half a page of text every second on the discs. That could be used for librettos, or words of a song for a singalong, or even the story of a symphony.

The compact disc will also be able to reproduce still photographs such as the portrait of the pop star, or a graphic to illustrate the song, such as a cannon in the 1812 overture, or even the title of the musical piece.

Whatever form, ultimately CD will have graphics, and Technics is one company pushing Philips to agree to standards as soon as possible. In fact, if you look at the rear of a Technics CD player you'll notice a DIN socket. That is there ready for the day graphics are available with CD. Technics will simply sell an add-on black box. One or two other companies are providing a similar socket.

So with audio linked to pictures what will happen with our old records and cassette tapes? This gadget from JVC fills the gap nicely. When your music doesn't offer a picture from your CD, laser video disc, or video hi-fi, JVC's graphic gadget will do the job instead.

Sound on chest

Finally as another talking point, mention must go to Pioneer's motorcycle jacket called a Sound Vest. A waterproof tape player fits in one pocket, a booster in another and there is a pair of speakers in the shoulders.

It gives the motorcyclist music on the move without needing to wear headphones. Much safer, if not as peaceful for people around. ●

B&W DM110 loudspeakers

The DM110s are something of an enigma. The performance at the bottom end of the audible spectrum could be improved but generally they perform well. Obviously one of the best speaker buys around.

Louis Challis

BOWERS & WILKINS in the United Kingdom have created an enviable reputation over the last decade with their loudspeakers. Their innovative technical approach to research and production is the envy of many of their competitors, but even B & W have to acknowledge that some of their competitors' ideas are worthy of consideration.

New concepts in products we have recently seen from Scandinavia and other European manufacturers have resulted in significant cost savings which have made B & W reassess some of their tried and proven production methods.

An exciting development in production is the use of plastic mouldings for construction of both drivers and cabinets. This makes it easier to mass produce speakers at a cost which decreases at almost the same rate as the quality of the finished speakers improves.

B & W's DM110 loudspeakers are probably one of the best examples of this production philosophy that we have seen since we reviewed the Jamo CBR 1703 loudspeakers (ETI July 1983).

The appearance of this bookshelf speaker system is particularly neat; the designers have incorporated most (but not all) of the features that the user would be seeking at a reasonable price. This has been achieved by using well designed front and rear panels fully moulded from plastic, with dampening and bracing accommodated within the design.

The mounting screw holes, speaker mounting holes, venting ports, panel retention clips for front covers and even the recessed terminal blocks are all accommodated neatly, effectively and most economically in the design. The two sides, top and bottom are constructed from high density particleboard and covered by simulated American Walnut plastic veneers.

The speakers also make extensive use of plastic mouldings which minimises their cost without significantly prejudicing any of their electro-acoustical performance.

The DM110 uses two drivers in a vertical arrangemnt with a 26 mm tweeter near the top of the cabinet. The dome and coil construction of the tweeter is based on a new construction approach; polyamide materials achieve lower distortion and a higher quality than was previously thought possible.

The bass/midrange speaker is a 200 mm driver with a high temperature voice coil supplemented by an impegnated, composite short fibre cone which is mounted near the bottom of the cabinet. This driver has a soft-roll surround which facilitates reasonably large cone excursions. The face of this driver incorporates a coloured retention ring; in the examples we received this was red but the manufacturer's data sheet states that it may also be blue. ▶

Immediately below the bass mid-range driver unit is a 50 mm diameter venting port with a 80 mm port length. The front panel cover is fabricated from particleboard with neatly contoured edges, plastic retention clips and an attractive, open-weave, brown, artificial fibre whose flow resistance is extremely low. The inside of the cabinet uses reticulated plastic acoustical foam for sound absorption.

The back panel incorporates two coloured universal terminals in the moulded well assembly, behind which is attached the crossover network. This particular crossover network is a first order difference filter which is not simple; the designers have managed to incorporate a 'fourth order Butterworth squared' filter that has relatively smooth crossover characteristics which do not appear to detract from the performance of the individual drivers.

Objective testing

The manufacturer's literature makes many claims for these speakers. Three specifications which immediately caught my eye are: the frequency response is ±3 dB from 70 Hz to 20 kHz; the free field cut-off frequency is 60 Hz; the second harmonic distortion at 90 Hz for 96 dB sound pressure level at one metre is less than 3%.

These claims are very enticing, especially for a pair of speakers selling at $399. The back page of the manufacturer's brochure, it should be noted, shows a picture of a CD disc and the equally enticing words 'Digital Monitors'.

We measured the acoustical performance of one pair of DM110s and then measured a second pair of these speakers.

In the anechoic room our first hopes were dashed when the frequency response proved to have a −3 dB response of only 90 Hz at one metre on the axis. However, the frequency response at higher frequencies is remarkably flat all the way up to and beyond 20 kHz. In fact, the frequency response is so flat that it makes many much more expensive speakers pale by comparison.

Obviously, with the speakers mounted on a stand (which does not come with the speakers) at the right height above the floor, this low end frequency response would be readily improved.

The manufacturer has made a brash statement that the claimed free field cut-off frequency is 60 Hz; we could not achieve this, no matter how hard we tried.

The claimed distortion characteristics for these speakers were our next problem. We tested four speakers but their performance did not come anywhere near the performance claimed in the brochure.

At frequencies above the knee of the cut-off frequency i.e: 115 Hz or above, the distortions most certainly fall within the range claimed by the manufacturer. However, at frequencies below this the selective cut-off characteristics of the speaker response results in a significant boost in the distortion products. It was physically impossible (at least in the units that we tested) to achieve the manufacturer's claimed performance.

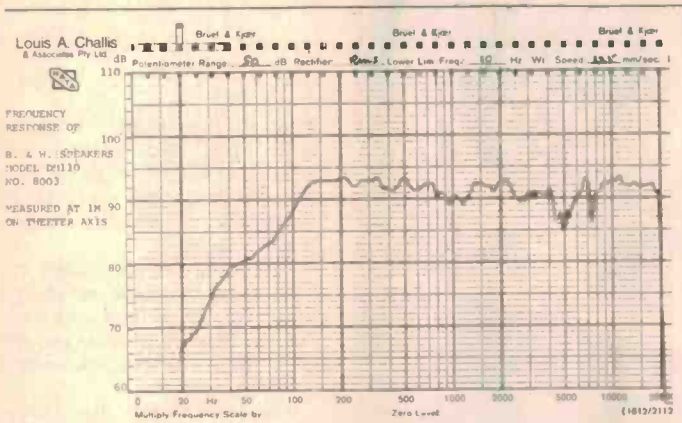
By this time we were a little bit disturbed that we had really come upon a 'lemon' and proceeded with the testing with even more trepidation than that which prevailed when we started our testing.

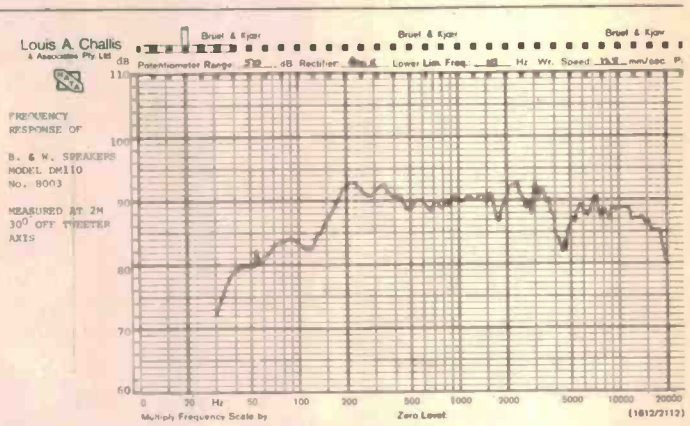
However, from that point on the test results assumed a completely different character. The tone burst testing revealed characteristics which were extremely good and which exemplified a speaker system with excellent transient characteristics.

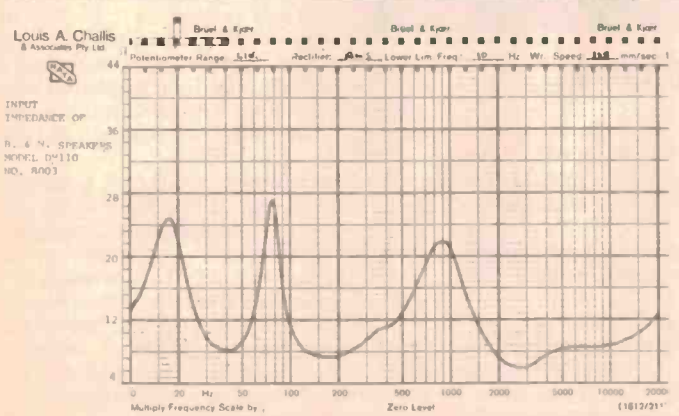
The phase response proved to be remarkably flat and was a credit to the speaker designers. The decay response spectra also turned out to be remarkably good and was extremely clean right across the important high frequency region.

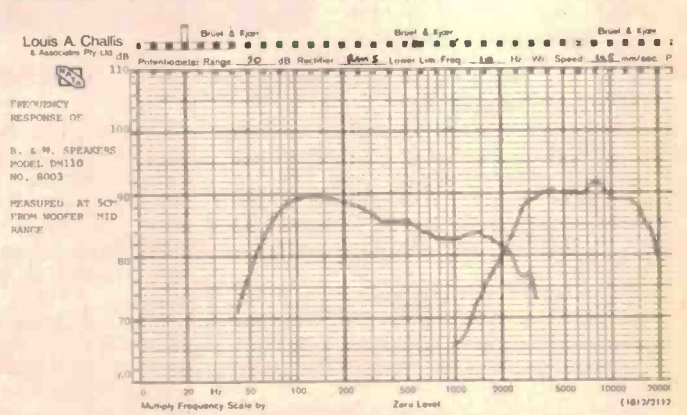
An examination of the impedance curve revealed what we believe isthe basic problem with the DM110s; the designers have tried to achieve far too much performance with a cabinet that has a volume which is just too small.

A close look at the impedance curve revealed that the fundamental cabinet resonance frequency occurs at 15 Hz, which is far too low; the second order resonance occurs at 80 Hz, which is not a particularly









MEASURED PERFORMANCE OF B & W MODEL DM110

SERIAL NO. 08003

FREQUENCY RESPONSE: 90 Hz - 20kHz ± 3 dB

CROSSOVER FREQUENCY: 2.5kHz

SENSITIVITY:

(for 90dB average at 2m) 6.7 VRMS = 5.6 Watts (nominal into 8 ohms)

TOTAL HARMONIC DISTORTION:

Total harmonic distortion at specified sound pressure levels (at 1m)

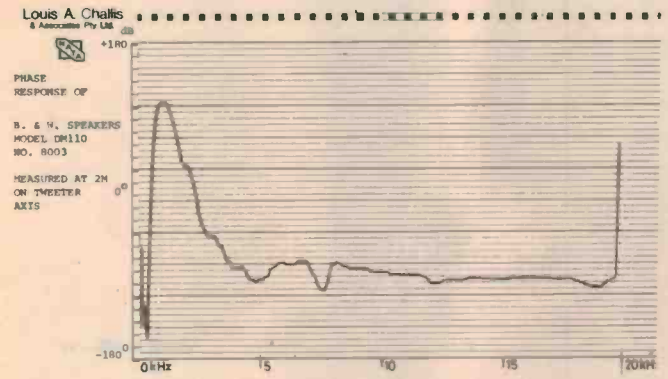
	80Hz	100Hz	115Hz	125Hz	150Hz	1kHz	6.3kHz	
90dB	4.2	2.0	1.1	0.9	0.8	0.8	0.8	%
93dB	6.0	4.2	1.3	0.9	0.9	0.7	0.7	%
96dB	36.0	24.0	2.1	1.1	0.9	0.6	0.7	%

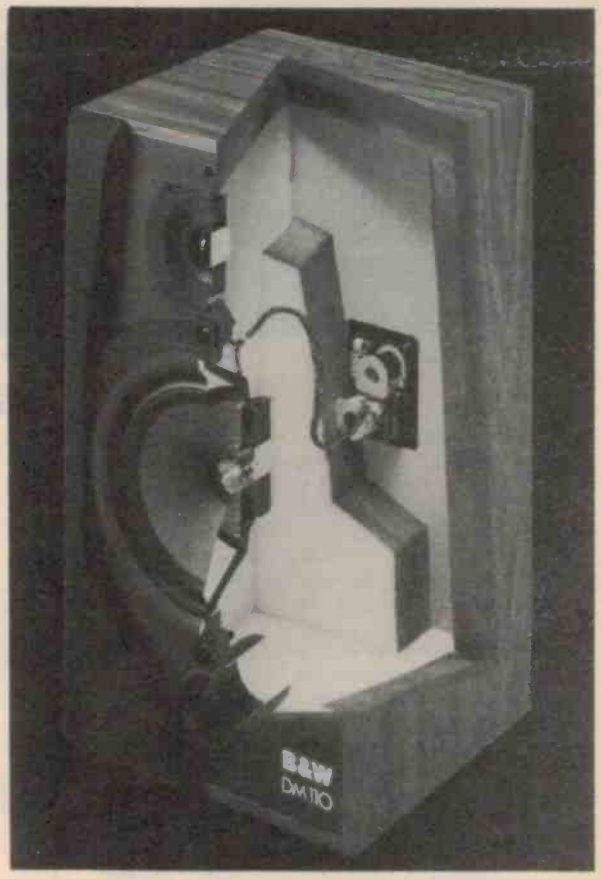
INPUT IMPEDANCE: 100Hz 11.2 ohms

1kHz 21.2 ohms

6.3kHz 8.5 ohms

Minimum at 2.4 kHz 6.0 ohms





inappropriate frequency and the speaker crossover takes place at approximately 2.5 kHz.

The minimum impedance is eight ohms, except in the region of the crossover frequency, where it drops down to 6.5 ohms. This means that this speaker system can be easily paralleled with a second eight ohm speaker system, without embarrassing most amplifiers.

Taken overall, and with the price of the speakers clearly in mind, the performance that the designers have achieved is still very good.

Subjective testing

The subjective evaluation of the speakers took considerably longer than it would normally have done as one of my children latched onto the DM110s whenever I wasn't listening to them. They fitted on his bookshelf as if they had been designed for that role. This, of course, is what B & W intended; they realised that most users want a set of speakers with just those dimensions and costing no more than $399.

The first thing I noticed was that provided you don't play very loud rock-n-roll, or extended passages containing drum or organ music, or treat the speakers as having the potential to replace a set of studio monitors, then the results are exhilarating and on occasions almost astounding.

The subjective assessment of the speakers proved to be a far less difficult task than I had imagined. I started the subjective assessment by comparing their performance against a set of B & W 801s, a pair of Quad electrostatics (Vintage 1970) and three other speaker systems which are renowned for their performance, albeit at three to five times the price.

B & W DM110 LOUDSPEAKERS

Dimensions:	*490 mm x 260 mm x 250 mm.*
Weight:	*8.7 kg*
Price:	*Rrp $399 per pair*
Manufacturer:	*B & W Loudspeakers, Meadow Rd., Worthing UK.*
Distributor:	*Convoy International, 400 Botany Rd, Alexandria NSW 2015. (02)698-7300.*

As I was in the middle of evaluating a series of new CD players I thought it appropriate to use them to evaluate the DM110s, particularly as the manufacturer claims that these speakers were designed primarily to be used with CD players.

The two discs that I chose are representative of the best of the new digitally recorded discs. The Phillip's disc, Mozart Piano Concerto in B Flat with the Academy of St. Martin-in-the-Fields (No. 400 018-2), revealed a magnificent stereo imaging capability and a quality of sound which was positively exhilarating. This was achieved at sound levels up to, but not exceeding, 100 dB. At higher levels the distortion tended to be unacceptable.

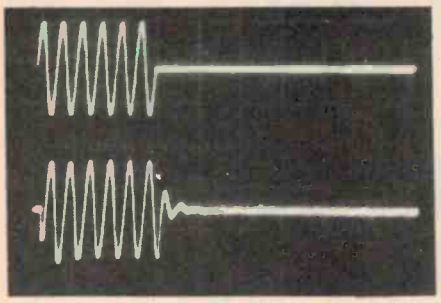
The Vertigo disc with Communique by Dire Straits (No. 800 052-2) was a sample disc provided by Phonogram Ltd. It contains some excellent passages of soft rock which the DM110s coped with quite happily at modest levels (less than 90 dB at one metre). However, they complained audibly at higher levels in the presence of low frequency content.

The results of this testing revealed that the DM110s can hold their own against almost any speaker system where the important or dominant frequency content is above 110 Hz, or the sound levels at two metres are kept below 85 dB (unweighted). The transient performance of these speakers is quite exceptional and on all of the test materials to which I listened I was impressed by their fidelity and clarity.

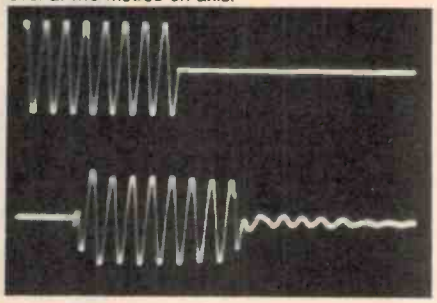
Their ability to handle speech is particularly good and as speech monitors they are really excellent. The transient performance is exemplified by the decay response spectra which is the best performance we have seen in any speaker system selling under $600. ▶

Tone burst response of the B & W DM110 loudspeakers. For 90 dB steady state sound pressure level at two metres on axis.

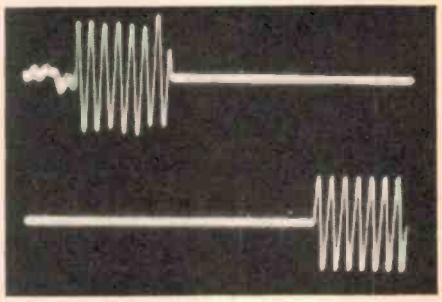
Upper trace is electrical input. Lower trace is the loudspeaker output.



Output at 100 Hz (20 ms/div).



Output at 1 kHz (2 ms/div).



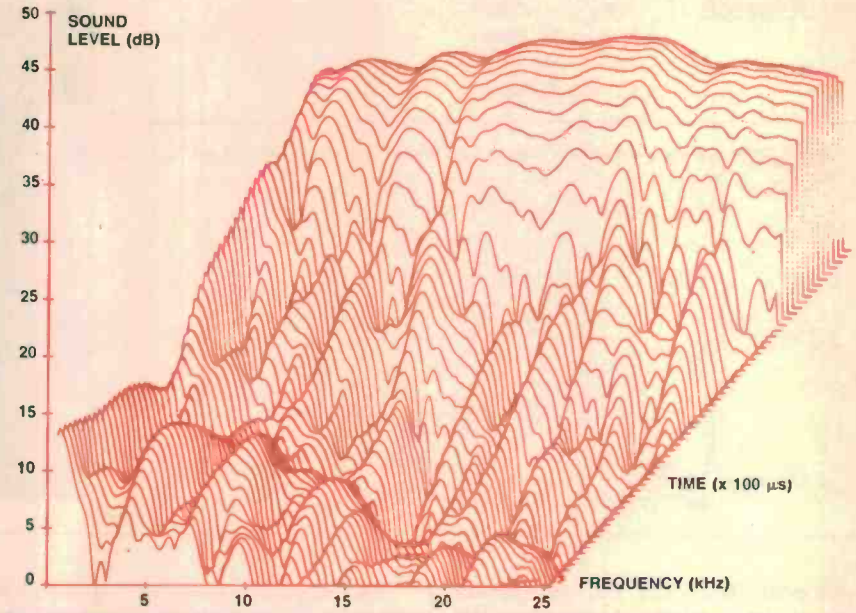
Output at 6.3 kHz (0.5 ms/div).

Conclusion

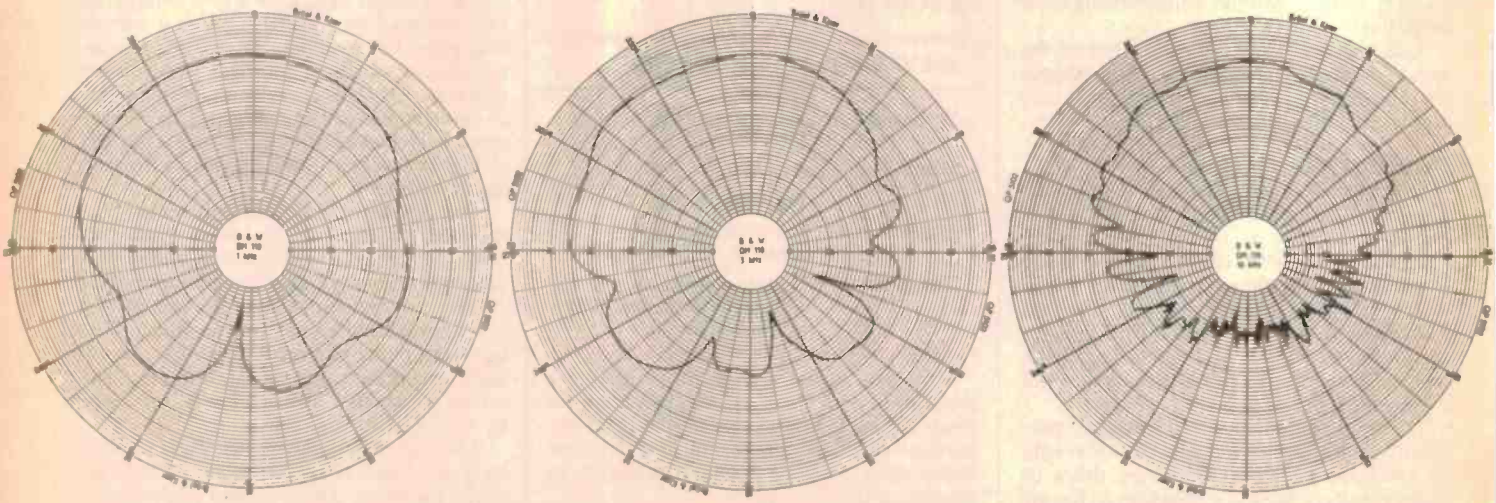
Yet for all this, the performance at the bottom end of the spectrum is in no way comparable with the performance at the top end. At frequencies below 110 Hz you tend to get what you pay for and in the case of the DM110s you are not paying for studio monitors or for a pair of large vented enclosures.

The basic problem with the DM110s is the conflict of purpose in the design which attempts to use a vented enclosure where a sealed enclosure might well just have the edge. Be that as it may, it is obvious that B & W could achieve a dramatic breakthrough by incorporating the same design philosophy in a larger member of the family. This would remove the obvious limitations and achieve the attributes which we are all seeking.

The DM110s are currently something of an enigma; they provide a general performance which is excellent but with obvious limitations which really only affect the performance at the bottom end of the audible spectrum. Even with these limitations clearly in perspective, the DM110s are still obviously one of the best speaker buys around at the moment. ●



Decay response spectra. Extremely good above 5 kHz; below 5 kHz the picture tells a different story.



1 kHz 3 kHz 10 kHz

B & W DM110 polar response curves.

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See page 117 for full address details.

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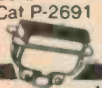

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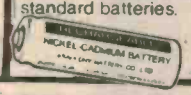

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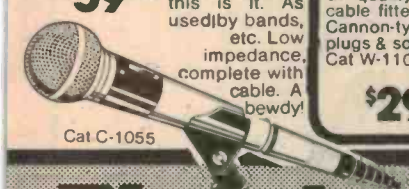

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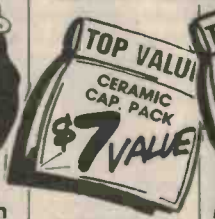

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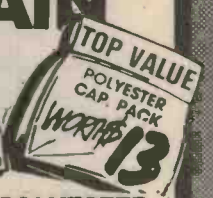

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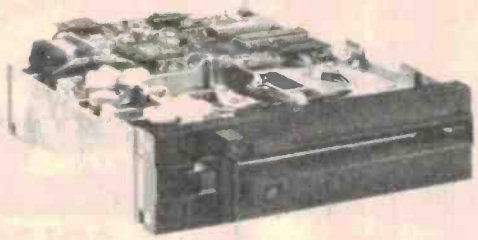


TANDON NEW EIGHT-INCH THINLINE DISK DRIVES

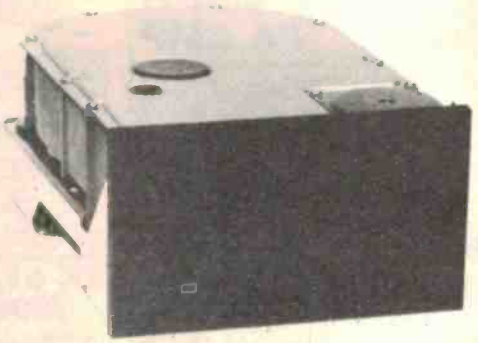
- Direct drive.
- Proprietary, high-resolution, read-write heads patented by Tandon.
- D.C. only operation—no A.C. required.
- Industry standard interface.
- Three millisecond track-to-track access time.

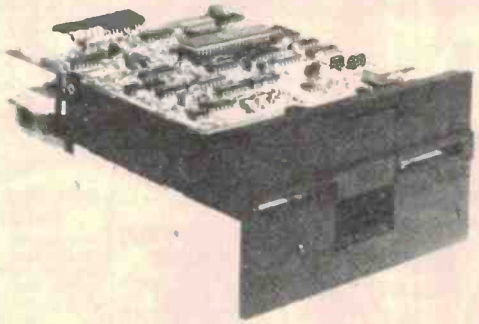
TANDON MODEL TM500 SERIES WINCHESTER DISK DRIVES

Tandon's low cost 5¼" rigid disk drive features an on-board microprocessor which calculates the optimum positioning algorithm, yielding an Average Access Time of 110 millseconds. This product family includes 1, 2, and 3 platter models with unformatted capacities of 6.4, 12.8, and 19.1 megabytes, respectively.

Up to four Tandom TM500's can be daisy-chained on a single bus, which provides a capability of up to 76 megabytes of on-line storage (unformatted) in a single system.

These drives are compatable with controllers that use an industry standard interface (ST 506).





Tandon Model TM-100 Mini-Floppy Disk Drives

Tandon's TM-100 family of mini-floppies offer the absolute highest storage capabilities of any 5¼" high-speed, random access disk drive available in two single head and two double head models, all double density.
Unsurpassed Storage Capacity—Up to an incredible 1000K bytes information on 160 tracks. Recording density is 5877 BPI.
Advanced Dual-Head Design—Tandom Magnetics has for years been the leading designer and supplier of read/write heads to most major disk drive manufacturers.
Increased Throughput—Tandon's TM-100 have a track-to-track access time of only 5 milliseconds (an incredible 3 milliseconds double track density).
Proven Reliability—Designed for total reliability, as demonstrated by more than 50,000 production models in operation.

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JUDGE RULES SOFTWARE NOT COPYRIGHT

Justice Beaumont of the Federal Court, in an action brought by Apple Computer Australia against Computer Edge Pty Ltd over the distribution of 'fake' Apples, ruled that none of the computer programs Apple claimed to hold copyright over was a literary work within the meaning of the Copyright Act.

"In my view, a literary work for this purpose is something which was intended to afford either information or instruction or pleasure in the form of literary enjoyment.

"The function of a computer program is to control the sequence of operations carried out by a computer", the Judge said.

David Roman, Apple Computer Australia's marketing manager was reported to be 'disappointed' at the result. Apple are likely to appeal.

The ruling, handed down in December last year, ended a seven-month court battle between Apple and Computer Edge who were selling the 'Wombat', a Taiwanese-made personal computer with many features similar to the Apple and incorporating operating system software alleged to be copies of the Apple OS.

Apple has a worldwide policy of taking action against manufacturers and distributors of look-alike computers, all of which have been successful to date in other countries, notably the US (against Franklin), South Africa and Taiwan.

This decision marks the first time Apple has lost such a case anywhere in the world.

Mike Suss, Director of Computer Edge, was 'ecstatic' over the result. He plans to start manufacturing Wombat computers locally this year.

IDT TAPE SUBSYSTEMS

Innovated Data Technology (IDT), developer and manufacturer of tape transports and intelligent peripheral systems, has introduced two new 13 mm nine-track 1600 cpi, IBM, ANSI, ECMA and ISO-compatible magnetic-tape systems for DEC Unibus and Q-bus computer systems.

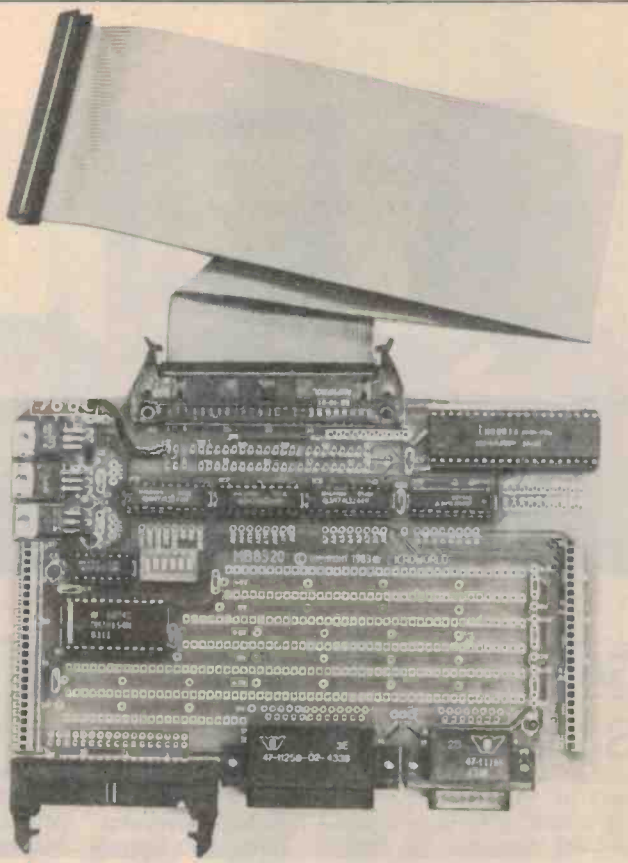
The tape subsystems utilise the IDT Series 1012 Virgo, which operates at 100 ips 'streaming' and 12.5 ips 'start/stop'.

The tape transport is available in vertical, horizontal or desktop mounting. Data recording is nine-track, and all drive support up to 26 cm reels.

IDT has also added a new 13 mm magnetic tape subsystem for the IBM/PC and XT users.

The TD-1012/PC-STR is a complete 13 mm subsystem using the TD-1012 transport in both the start/stop (12.5 ips) and streaming mode (100 ips) and includes basic application software.

For further details, contact **Mostyn Enterprises, 35 Alexander Street, Dundas NSW 2117. (02)871-6297.**



MICROBEE EXPANSION EXPERIMENTER BOARD

Applied Technology has come up with an expansion board to suit all you 'Bee owners who aren't afraid to wield a soldering iron and wish to experiment with all sorts of circuits and add-ons.

The board incorporates the following facilities: buffers for the address lines, bidirectional data buss buffer, buffers on outgoing control lines, decoding for 16 ports, two parallel ports using the spare ports decoded on the Microbee and on-board voltage regulators to give +5 V, +12 V and −12 V.

Other features include: input/output sockets, a generous prototyping area and two edge connectors to add an extra board for further experiments.

Applied Technology kindly gave us production board No. 1 for a quick look just as we went to press. It's a well-manufactured board, has a dry film solder mask and topside silk-screened overlay so you 'know where you are' on the board.

To make full use of it requires making a small mod. to your 'Bee to use the spare internal ports. It's simple; cut two tracks and add two links — voila! Plug in the expansion board and you have two extra parallel I/O ports to use.

Ports available on the expansion board are nos 4, 5, 6 and 7 linked together, and port 0A, plus 16 ports located at any 10 hex boundary between 20 and 70 hex. That's a total of 21 ports. If this isn't enough, you can add another decoder to get a further eight or 16 ports.

Applications — are up to you. Ours came with documentation outlining a door bell and burglar alarm system. We think this board has lots of possibilities. Sorry, no firm price yet, but it shouldn't strain the cash resources of most keen computerists.

Further details from Microbee dealers or direct from **Applied Technology, 1 Pattison Ave, Waitara 2077 NSW. (02)487-2711.**

SANYO'S ANSWER TO IBM

Sanyo Data Systems will launch its answer to IBM's personal computer this month, the MBC 555.

The MBC 555 is seen as a true personal computer, as distinct from Sanyo's range of business computers.

The new computer features an 8088 16-bit processor and 128K memory, expandable up to 256K. The computer's 32K video RAM means the MBC 555 can also provide high resolution graphics (640 x 200 dots) when using the optional high resolution monitor. Dual disk drives give disk storage of 320K, and an additional 320K option will be available early in 1984.

"We see the MBC 555 as a real alternative to IBM's personal computer," said Mark Johnston, Sanyo's Managing Director. "It is compatible with the IBM, yet offers the additional incentive of being half the cost of the IBM.

Mr Johnson said the MBC 555 is the first of three new computers to be launched by the company towards the end of the year.

for further information, contact **Sanyo Data Systems, 127 Walker St, North Sydney NSW 2060. (02)929-4644.**

T/MAKER COMBINES WORDS AND FIGURES

Alfatron has started to distribute the T/Maker software package in Australia. It is available for both CP/M 80 and CP/M 86 plus several other operating systems.

T/Maker is used for word processing, as a spreadsheet calculator, bar charting, file mangement, list sorting and tallying. It allows the user to manipulate words, numbers and lists singly or all at once.

The word processing is done with a screen editor which allows configuration to use cursor control keys and/or specific function keys.

Alfatron has also been granted the distribution rights to the popular card cage and board from Electronic Solutions in the United States. These products include multibus card cages from 3 to 72 slots capacity in both horizontal and vertical mounting types.

Industrial and heavy-duty cages are also available for standard racking systems. Cages are available with two different spacings between cards to suit wire wrap cards.

For further details, contact **Alfatron, 1761 Ferntree Gully Road, Ferntree Gully Vic. 3156. (03)758-9000.**

NEW ATARI MODULES

Futuretronics, the Australian distributor for Atari, has announced the release of three new expansion modules for the Atari.

'Paint' is a program that allows the user to create computer graphics without having to program anything. 'Paint' turns the computer screen into a canvas and the joystick into a paint brush. Available on diskette, the program allows the user to mix colours, make patterned paint, draw perfect lines, circles and rectangles and even zoom in to do close work and zoom out again to see the results.

Atari Logo is now available in a 16K cartridge that can be used on an Atari home computer with as little as 16K RAM memory. This is the only full-featured version of Logo that can be used with so little memory.

The third new expansion module is an external microprocessor upgrade that allows high-powered CP/M software to be used with all models of Atari home computers as it is fully compatible with either the Atari 810 or Atari 1050 disk drives. The CP/M add-on offers 40 or 80-column video display output on a switchable basis.

Also planned for release is the Atari Expansion Box and the 64K Memory Module. For further information, contact **Futuretronics Australia Pty Ltd, 1076 Centre Road, Oakleigh Vic. 3166. (03)579-2011.**

CICADA MODEM-PHONE

Centre Industries is following up the successful Cicada 300 baud data modem with a 'new, improved' version featuring an integrated telephone.

The new Cicada 300T can be simply installed by the purchaser, without any need for a Telecom technician.

According to Centre Industries sales manager, Mr George Weisske, pricing on the new 300-baud modem with telephone will be within about $40 of the current $229 recommended retail price of the Cicada 300 model, which has now been on the Australian market for about nine months.

The Cicada 300 has developed a strong share of the modem market, with substantial government interest in addition to hobbyists and business users.

The new Cicada 300T is a compact, answer-and-originate unit designed to plug directly into a standard telephone wall socket for computer interface, using either an RS232C or a V24/V28 system.

The modem is aimed at home and small business users of local, STD and ISD facilities for inter-computer communication. The unit measures 203 x 152 x 63.5 mm and holds Telecom approval number C83/37/1011.

For further information, contact **Centre Industries, P.O. Box 184, Brookvale NSW 2100.** ▶

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SPECIFICATIONS

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- *Detachable, capacitive, typewriter-style keyboard*
- *N-key rollover with auto repeat capability*
- *4 LED indicators for caps lock, on line, block mode and keyboard lock/protect*
- *Audible keyclick enable/disable*
- *Auto repeat enable/disable*
- *Keyboard lock enable/disable*
- *Repeat rate 20 characters per second*
- *5 cursor control keys, 10 editing function keys with 14-key numeric key-pad*

Communication
- *Code: 128 ASCII characters*
- *Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200*
- *Parity: Odd, even, mark, space*
- *Operating Mode: Full duplex, half duplex or block mode*
- *Interface: EIA RS-232C or 20-mA Current Loop*

Emulation
- *LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT*

Screen Presentation
- *Display format: 24 lines x 80 characters*
- *Display unit: 12-inch, non-glare Green CRT*
- *Character type: 7 x 9 dot matrix*
- *Refresh rate: 50/60Hz*
- *Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols*
- *5 screen attributes: Blink, underline, blank, reverse, dual intensity*
- *Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor*

Editing Function
- *Cursor: up, down, left, right, home*
- *Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.*

External Control
- *Power on/off*
- *Contrast adjustment*
- *Baud rate*
- *Parity and data format*
- *End of message*
- *Emulation mode*
- *Refresh rate*
- *Half duplex or full duplex*
- *Auto line feed*
- *Auto new line*
- *EIA or 20-mA Current Loop*
- *Reverse video or standard video*

ENQUIRIES FROM: AVAILABLE FROM OFFICES AND SHOWROOM PARIS RADIO ELECTRONICS, SHOP 1, 165 BUNNERONG ROAD, KINGSFORD, NSW 2032. TEL. (02) 344 9111. TELEX AA22579.
MAGRATHS ELECTRONICS 55 A'BECKETT ST, MELBOURNE, 3000 VICTORIA. TEL. (03) 347 1122.

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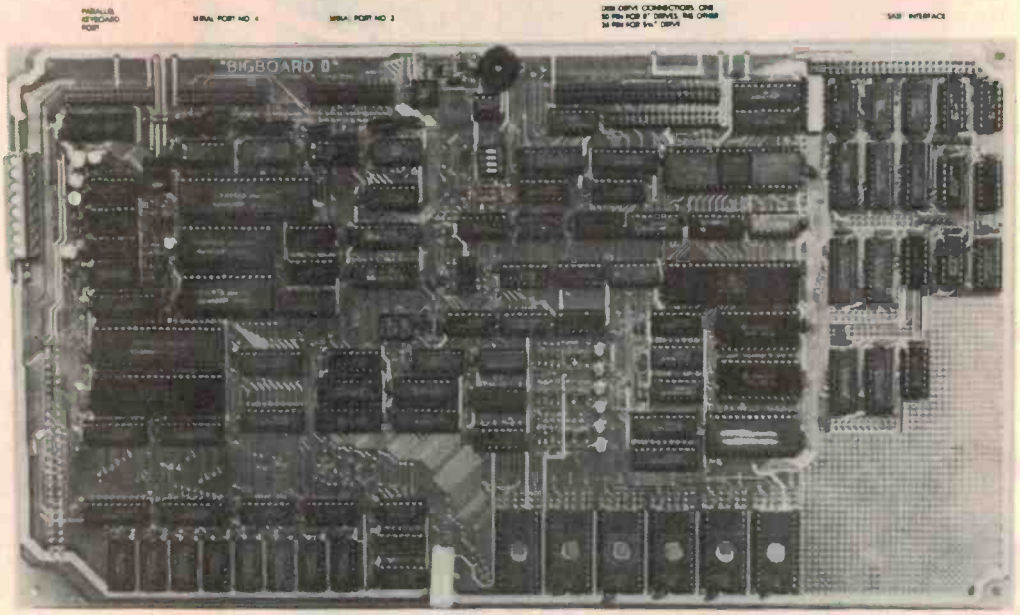
"BIG BOARD II"



EPROMs shown only for clarity.

STD Bus Connector

Prototyping Area

Jim Ferguson, the designer of the "Big Board" distributed by Digital Research: Computers, has produced a stunning new computer called "Big Board II", it has the following features:

4 MHz Z80 — CPU AND PERIPHERAL CHIPS

The Ferguson computer runs at 4 MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

64K DYNAMIC RAM + 4K STATIC CRT RAM + 24K E(E)PROM OR STATIC RAM

"Big Board II" has the three memory banks. The first memory bank has eight 4164 RAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732 As, 2Kx8 staticRAMS, or pin-compatible E(E)PROMs. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full kit, Or assembled and tested, it comes with a 450nS2732 EPROM containing the monitor.

MULIPLE-DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS

The new Ferguson single-board computer has a multiple-density disk controller. It can use 1793, 1797, or 8877 controller chips since it generated the signal with TTL parts. The board has two connectors for disk signal with 34 pins for 5.25" drivers, the other with 50 pins 8" drives.

VASTLY IMPROVED CRT DISPLAY

The new Ferguson SBC uses a 6845 CRT controller and 8002 Video Attributed controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5x7 dot matrix on 15.75 KHz monitors and 7x9 dot matrix on 18.60 KHz monitors. The display is user programmable with the default display 24 lines of 80 characters. 8002a chip supplied for 18 to 60 kHz monitors.

STD BUS CONNECTOR

The Ferguson computer brings its bus signals to a convenient place on the PC board where users can solder an DSTD, bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry-standard card cages.

DMA

The new Ferguson computer has a Z80-A DMA chip that will allow byte-wise data transfers at 500K bytes per second and bit serial transfers via the Z80-A S10 at 880K bytes per second with serial processor overhead, though the monitor for the new computer uses the DMA chip mainly for transferring data to and from disk, the chip can readily be used for other things since its "wait/ready" pin can be connected under software control to some half a dozen signal lines. When a hard-disk subsystem is connected to the "Big Board II" via its "SASI" interface, the DMA chip makes breathtaking disk performance possible.

"SASI" INTERFACE FOR WINCHESTER DISKS

The "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface". Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1: Runs a 50-conductor ribbon cable from a header on the board to any of several inexpensive controller cards for Winchester drives that implement the controller portion of the SASI interface. 2: Cables the controller to an appropriate drive, and 3: Provides power for the controller-card and drive. Since our CBIOS contains code for communication with hard-disk, that's all a user has to do to add a Winchester to a system!

A Z80-A S10/0 = TWO ASYNCHRONOUS/SYNCHRONOUS SERIAL PORTS
A PARALLEL KEYBOARD PORT = FOUR OTHER PARALLEL PORTS USER 1/0

The new Ferguson single-board computer has one parallel port for an ASCII keyboard and four others for user-defined 1/0. When the computer is powered-up or reset, the monitor looks for a carriage-return at the keyuboard and serial ports. If the first carriage-return the monitor gets comes from the parallel keyboard, the monitor uses the board's video display circuitry to communicate with the user via a CRT. If the first carriage-return is typed at an ASCII terminal attached to a serial port, the monitor autabauds and makes the terminal the system console.

TWO Z80-A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS

The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S10/0, while the other is for systems and application use.

PROM PROGRAMMING CIRCUITRY AND SOFTWARE

The new Ferguson SBC has circuitry and drivers for programming 2716s, 2732(A)s, or pin-compatible (E)EPROMs. Sonware $25 extra.

CP/M

CP/M with Russell Smith's CBIOS for the new Ferguson computer is available for $220. The CBIOS is available separately for $65.

Actual board size: 39.6cm x 22.2cm. 5 inch BIOS being developed. Approx price $95.

Pricing and Availability:

Available ex-stock

In single quantities, full kits cost $695 Inc. tax , and A&T'd computers cost $895. There are attractive discounts that range to 35% for OEM's and dealers. For details about them please call Rod Irving on (03) 489 7099. ie: 3 Ferguson II "Big Board" are less 20% off the one-off price, hard disks disk controllers, boxes and power supply to suit both 8" & 5¼" systems will be available.

Bare board with main chips now available (includes PCB, Manual, PALS, Monitor ROM, SMC chips). You have to add rest of components at $395 + tax

Errors and omissions excepted.

VIC EDUCATION FROM COMPUTER CLASSICS

Despite the popular notion that children hate the discipline involved in the learning process, education experts have found that children want and love to learn — provided they are not exposed to stress, boredom and frustration.

Computers can teach basic skills in such subjects as maths and language — and make the learning fun at the pace necessary for each child.

Incorporating fun in the learning experience is the essence of VIC education, a new concept in skills-teaching by Computer Classics.

The VIC education series is designed for use on the VIC-20 home computer and the 1530 Commodore Datasette. The programs comprise a maths series and a language series, each teaching basic skills at progressive levels, plus a challenging 'game' called Supermind which sharpens observation and memory skills.

VIC Education was developed by a team of computer educationists in Australia, and is geared toward Australian schoolchildren, an advantage over most education programs from overseas.

Every program has been tested by children of all ages and abilities, and their experience helped develop final programs.

For further information contact **Computer Classics, 11-15 Falcon St, Crows Nest NSW 2065. (02)438-4866.**

BOOST FOR DIGITAL ELECTRONICS

Digital Electronics has announced the stepping up of plans for its own 68000 processor and major commitments to the Unix operations system, following a large investment by Business Loans and Equity Capital (BLEC).

The investment, totalling almost $500,000, was said by BLEC general manager Harold Tilley to be his firm's largest to date.

BLEC, a subsidiary of the Westpac Banking Corporation, backs small and medium Australian businesses with loans while taking shares in the companies it finances.

As a result of the investment, Sydney-based Digital Electronics, which has grown in 14 years' operation to a $6.5 million turnover, will implement marketing and technical plans, such as the 68000 processor and Unix.

CONTROL DATA SUPPORTS VIDEOTEX

Control Data Australia has announced its support of The Minister for Communication's announcement that Telecom was to provide a national public videotex service.

Since February 1982, Control Data has operated a national public access videotex service targeted at the business community. This service, 'Cybertel', is based on the 'Prestel' protocol using the IVS software supplied by Aregon International of the UK.

Customers of Control Data's videotex service include General Motors-Holden, Jetset Tours, Northern Territory Development Corporation, Syme Media, Creative Communications, Australian International Finance Corporation (AIFC) and Bass Communications.

Mr Bob Easson, Control Data's business development manager, who has planned and managed Cybertel since its inception, said, "Control Data has always publicly supported the role of Telecom providing a national videotex service; as long as Telecom also provides interactive 'gateways' at low cost to private or other semi-public videotex hosts such as Cybertel.

"Telecom is in the enviable position of being the monopoly carrier which, at the lowest cost, can maximise community access and offer remote users cost-effective access to the same information available to users in metropolitan areas. Current and future customers of Control Data will benefit from the availability of this wider access provided by Telecom, above and beyond Control Data's national communications network. Provided Telecom adopts a fair and realistic pricing policy for the proposed videotex services, Control Data believes it will compete favourably with Telecom's information offerings."

Mr Easson said it was Control Data's intention to 'gateway' Cybertel to Telecom's service immediately it was available. "Now potential information providers have the opportunity of 'getting started' without risk using Cybertel videotex today. The compatibility of Cybertel and Telecom videotex databases (Prestel format) underwrites the investment in creating the information provider's initial database, or conducting a 'trial' using Cybertel."

For further information contact **Control Data Australia, 493 St Kilda Road, Melbourne Vic. 3004. (03)268-9500.**

MICROTRIX MOVE

The Melbourne-based firm of S100 board specialists, Microtrix, has moved from its former address at Montmorency to new premises at Eltham.

Well-known for its comprehensive range of locally made and imported S100 products, Microtrix has recently introduced a new SBC from Octagon which sports both an 8-bit and a 16-bit CPU, two serial ports, a floppy disk controller with DMA and an interrupt controller, among other features.

Also recently released is its new 64K CMOS static RAM board for the S100 buss (to IEEE-696), featuring extended addressing, bank select, battery backup, 6 MHz operation with a Z80B or 8-10 MHz operation with 16-bit processors.

For details on these and more S100 goodies, contact **Microtrix, now at 24 Bridge St, Eltham Vic. 3095. (03)439-5155.**

PUT IT IN YOUR MIT!

Interact Technology, a new market development company specialising in Australian electronic and computer products, has announced a new low-cost computer access device known as the 'MIT' (Miniature Inquiry Terminal).

the MIT is a portable unit that is placed over the mouth-piece of a telephone. By pressing the numeric buttons on the MIT the user can communicate directly with a computer.

Any computer can be equipped with a voice modem to answer the user with pre-recorded voice responses. The computer can therefore provide information requested, or ask the caller to enter data on the MIT. The MIT will sell for approximately $50.

Applications include; credit card verification where a vendor can obtain immediate authorisation advice; telephone purchasing where customers or sales people can obtain availability or pricing information and place orders, and data collection of any simple data needs to be acquired rapidly, such as financial data or opinion surveys.

The device operates by emitting an audible tone that is unique for each of the twelve keys provided. These tones are the same as those used for touch-tone dialling.

At the computer end, a voice modem is necessary to decode to tones received from the MIT, and also to cause the pre-recorded voice responses to be sent.

The computer must have a program that interprets the information received from the MIT, and can select the appropriate voice responses from its memory.

Interact Technology, the company behind the MIT, aims to fill a growing need in the expanding high technology industries. That need is the ability to take an innovative product from the design stage through to manufacturing and successful marketing.

Interact examines product opportunities and those that meet its selection criteria are evaluated as possible product joint ventures. For further information contact **Interact Technology, 518 Camberwell Road, Camberwell Vic. 3124. (03)299-2099.**

ANDERSON JACOBSEN AGENT

Mostyn Enterprises has been appointed the Australian distributor for Anderson Jacobsen modems and acoustic couplers.

Anderson Jacobsen, of San Jose, California, is one of the world's leading suppliers of modems and acoustic data couplers. The firm currently boasts the only commercially available 4800 bps full-duplex two-wire modem, the AJ4048. This modem is currently used overseas as a dial-up modem for connection to the public switched network and it can also be used on two-wire leased lines.

For further information, contact **Mostyn Enterprises, 35 Alexander Street, Dundas NSW 2117. (02)871-6297.**

COLOUR VDT MAKES IT A WYSE TRILOGY

The Wyse WY-300 colour video display terminal was released at the 10th Australian Computer Conference.

Assembled in Australia by MicroProcessor Applications, the WY-300 completes a trilogy from Wyse, following the WY-100 and the WY-200.

The WY-300 offers the features of the WY-100, plus full colour. It is designed to operate in WY-100 mode and WY-300 mode.

The WY-300 is a smart editing character oriented video display which displays data in eight colours on the CRT screen. It also contains a soft character generator into which up to 256 custom symbols may be loaded from the host computer.

Features of the WY-300 include: clear, 80 column high resolution, eight colour display; hidden colour attributes; extensive alpha-numeric and line drawing symbols; soft downloadable character generator; compact ergonomic design with swivel and tilt CRT and detached keyboard; text editing and forms data entry functions; 105-key keyboard; two independent RS232 ports to 19.2 Kbps; soft keycodes.

The WY-300 also has a Wyse (single page) compatible mode in which the monochromatic attributes of dim, reverse, etc, are translated to colours. This means that users can take advantage of colour without having to reprogram the host computer.

The WY-300 includes a 12 inch (30.48 cm) diagonal CRT which can display red, green, blue, yellow, cyan, magenta, white and black. The display provides a screen format of 870 columns by 26 rows with each character position consisting of a 10 x 11 cell matrix.

A pre-defined set of symbols is permanently stored in ROM. These are automatically loaded into the soft character generator upon power-up. This symbol set includes the full 96 ASCII display symbols, the 32 ANSI control code symbols and an extensive drawing line set.

The soft character generator provides the capability to display many symbols for line drawings, bar charts and histograms. Speeds, bits per character, stop bits and parity are switch selectable by DIP switches on the keyboard.

For further information contact **MicroProcessor Applications, 48 Rutland Road, Box Hill Vic. 3128. (03)890-0277.**

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Full 60 Key Qwerty Computer Keyboard exactly the same type as has been used up to now with the famous Microbee Computer. SPST keys. Complete with mounting plate, all key caps etc. Fully assembled. Incredible value — Be Quick!

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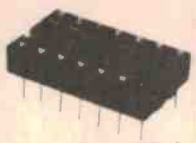

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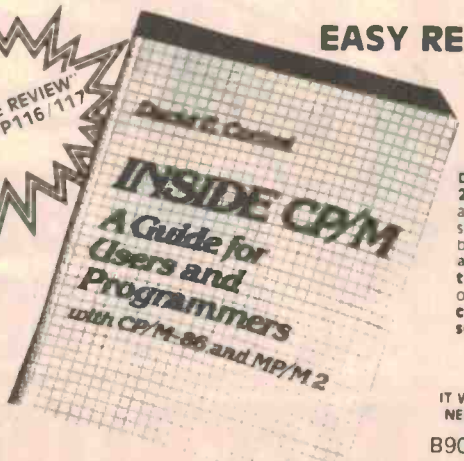

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MICROSOFT COMES ASHORE

The Microsoft Corporation (USA) has announced the purchase of the Sydney-based Wiser Laboratory's Wiser-Microsoft division.

Wiser-Microsoft was appointed Microsoft's exclusive distributor for Australia and New Zealand 18 months ago. Since then, Wiser has grown to become the second largest Microsoft distributor in the world.

Scott Oki, Vice-President of Microsoft International, says, "Microsoft Corporation's commitment to the Australian marketplace is expanding and both Wiser and ourselves feel that it is desirable to change this form of Wiser-Microsoft in order to better realise this larger commitment. This is why we've made the distributorship our wholly owned subsidiary."

Microsoft will be introducing a comprehensive range of personal business software tools during the coming year. Wiser Laboratory's General Manager, Linda Graham, will now be General Manager of the new Company.

For further information contact **Wiser-Microsoft, 21 Tepko Road, Terry Hills NSW 2084. (02)450-2522.**

GORTEK MAKES CHILD'S PLAY OF PROGRAMMING

Commodore Computer has given birth to Gortek, a robot-like character designed to help children learn computer programming, in a series of books and cassette tapes.

The first series, entitled *Gortek and the Microchips*, is aimed at children up to 14 years and consists of two cassette tapes containing 12 educational programs. It also includes an instruction book with colour illustrations, large easy-to-read type and a language-level aimed at older children. It can also be used by younger children, with parental guidance.

Gortek, which is designed for use on the Commodore 64 microcomputer, was developed by three British school teachers who wanted to make programming fun to learn.

For further information, contact **Commodore Computer, 5 Orion Street, Lane Cove NSW 2066.**

MOBILE THERMAL PRINTER

Datel has added a mobile 20-column thermal printer to its printer product line. Called the Model APP-M20D, it is smaller than a CB radio and weighs only 1.2 kg complete. The unit is available in either parallel or serial RS232-C versions.

Applications include ambulances, delivery vehicles, communications vehicles, police, fire brigade and military vehicles, as well as meteorological and oceanographic vessels.

A mounting bracket with slides is shipped with each printer for easy installation and removal. A spring-loaded single-plunger locking mechanism is also provided to prevent theft when left unattended.

The APP-M20D has microprocessor-controlled interface, compact size and quiet, rapid printing.

Both versions of the APP-M20D print the full ASCII character set in 20 columns across 59 mm wide thermal paper. A dot-line thick film, thermal printhead forms 5 x 7 dot-matrix characters which are 3 mm high. The print rate is 63 lines per minute. A standard 45-metre roll of paper, prints almost 9,000 lines at two lines per centimetre spacing.

The printer outline dimensions are 113 x 69 x 222 mm.

For more information, contact **Elmeasco Instruments, 15 McDonald Street, Mortlake NSW 2137 (02)736-2888.**

Microbee-No.1 for computers
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Jaycar Electronic Agencies is proud to announce the 1984 range of microbee computers – at new low prices!! The microbee Series 2 machines are ALL supplied with built-in communications capability, dual font 80 character by 24 line & 65 character by 16 line displays. Remember, your microbee is obsolete-proof with g'teed upward expandability.

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microbee Series 2 EXPERIMENTER

By popular request, the low cost microbee Series 2 Experimenter has been designed for those who are starting out in the fascinating world of computers or those who want to share the fascination of exploring the exciting developments in the fast moving MICRO WORLD.
Demand for projects using the microbee is so great that 'Electronics Today' are now planning to run a microbee project every month during 1984. So far ETI has described the light pen, EPROM programmer, a radio TTY printer, the world's first home facsimile receiver and ROM expander board for the microbee. Virtually every local computer magazine has run reviews and/or columns devoted entirely to the microbee. If you want to be part of the MICROCOMPUTER GENERATION in 1984 then microbee Series 2 Experimenter is the ideal starting point. Of course you can expand your microbee Series 2 Experimenter as your need grows.

$399 Cat. XE-4000

Note: the software that is supplied with each machine – at no extra charge!!

microbee Series 2 EDUCATOR

The microbee Series 2 was specifically designed to serve the needs of the EDUCATION MARKET. Let's face it, the primary non-business use for most personal microcomputers is to increase our learning capabilities either about computers (computer awareness) or about life itself. microbee Series 2 has now been officially approved by Education Departments in NSW, WA and Queensland and is being carefully considered in virtually all other states and by the National Schools Commission at the time this ad was going to press.
The microbee Educator uses BATTERY BACKED NON-VOLATILE CMOS RAM so your programs are saved in the microbee Series 2 after the power is switched off. Students can bring the microbee Series 2 Educator home from school to complete assignments ready for class the next day. With the optional BEEMODEM you can use your microbee Series 2 Educator to talk to other computers or information networks.

$449 Cat. XE-4050

microbee Series 2 PERSONAL COMMUNICATOR

With the BUILT-IN WORDBEE in ROM as well as MICROWORLD BASIC and NETWORKING, the Personal Communicator is a powerful home computer ideal for virtually any home use from wordprocessing, spreadsheet analysis, eduction and even experimentation with the computer concepts as they evolve during the year. With the optional BEEMODEM you can send WORDBEE files across any telephone line to another computer. Bee the first on your block to have home telex!

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microbee Series 2 ADVANCED PERSONAL COMPUTER

Now for the first time in Australia: the microbee Series 2 Advanced Personal Computer with 400K disk drive. Then add bundled world class software such as CP/M, MICROSOFT BASIC, MULTIPLAN, WORDSTAR and a powerful library of support programs and you will have some idea as to why the microbee Series 2 Advanced Personal Computer is the most powerful and best price/performance computer in its class. What's more any existing microbee owner can convert his microbee to the Series 2 APC at any time.
The microbee Series 2 APC uses the popular Z80 microprocessor and runs standard CP/M so that users have access to the vast library of CP/M software available world wide. MICROSOFT BASIC is now supplied on disk. WORDSTAR, according to independent surveys now accounts for 50% of ALL word processing software now in use so the designers of the Series 2 APC decided to purchase the OEM rights for your benefit. MULTIPLAN is considered by many to be one of the most powerful spreadsheets yet produced for the microcomputer.

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MICROBEE

KITS–KITS–KITS–KITS–KITS–KITS–KITS

ETI 733 RTTY Convertor. Ref: ETI April 1983. This simple project allows you to hook up your MicroBee to a HF receiver and print radio teletype messages on a monitor screen. Listen to world news for FREE!!
Cat. KE-4654 ONLY $17.95

ETI 649 MicroBee Light Pen. Ref: ETI August 1983. This simple, low cost device plugs into the Bee's 8 bit port. The "pen" gives you an entry into the world of light pens and interactive software.
Cat. KE-4656 SHORTFORM $19.50
SPECIAL PROBE CASE TO SUIT (as specified in ETI article) Cat. HB-6400 $19.95

ETI 668 MicroBee EPROM Programmer. Ref: ETI February 1983. This simple, low cost EPROM programmer just plugs into the Bee's I/O port and enables you to save programs in any of the 5 different common EPROMs available (2716, 2532, 2732, 2732A, 2764). Kit comes complete with 'Personality' plug and all IC sockets.
Cat. KE-4650 $39.95

Parallel Interface Kit for the MicroBee. Includes 15 pin 'D' plug – add $15.00 if Centronics plug required.
Cat. KE-7017 $15.00

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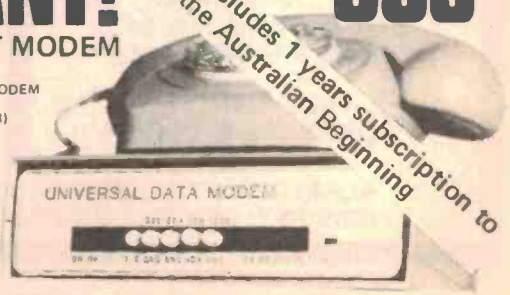

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A program with very good graphics using little characters to entice the user to think what word is either a synonym, antonym or homonym of the word they are showing. Everytime you get it wrong you are given more clues. After the clues run out you must face the Dragon when you must spell the word he is holding correctly before you.
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MUSIC – B – MYTEK
MusicB is a music Composer/Editor that lets you create and save music and sound effects with a flexibility that makes chopsticks of the Basic PLAY command. MusicB is a great way to learn and play music! Comprehensive instructions are included.
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TRSBEE – MYTEK
TRSBEE is a package of three programs that loads TRS-80 Model 1 and 3 program tapes into the MicroBee without any additional hardware. Although some program editing will still be required prior to their running, the majority of program typing time is saved by TRSBEE. The first program loads TRS-80 BASIC programs into MicroWorld BASIC. Most prgrams may then be edited and run. The second program in the package loads any TRS-80 machine code file into MicroBee memory. The third program loads TRS-80 assembler files into the MicroBee EDITOR/ASSEMBLER. Any TRS-80 Model 1 or 3 tape may be loaded. TRSBEE opens up a whole new world of possible software on your MicroBee!
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BASIC TUTORIAL
Is a super teaching aid for any classroom. Basic Tutorial is a set of 9 interactive exercises designed for teaching Basic to the computer novice. No previous knowledge is assumed. Basic Tutorial uses a unique double screen technique to display both the normal computer output and the tutorial exercises at the one time. This allows the student to use the MicroBee in the normal way, while the tutorial instructions appear in the lower half of the screen.
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Consists of 8 interactive exercises designed for teaching machine code programming and related topics as they apply to the MicroBee computer. Only a general knowledge of the BASIC language is assumed. Machine Code Tutorial is designed to bridge the gap bewteen BASIC programming and being able to understand and use typical Z80 manuals.
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Basic decoder and listing formatter
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DATABEE
This program is a well written data base management system that utilised the MicroBee to its fullest to provide a Data Management System similar to those found on larger and more expensive systems. This comes complete with large bound manual.
Cat. XE-6945 $19.95

ASTEROIDS PLUS – MYTEK
Asteroids Plus is one of the finest high resolution graphic arcade games available for the MicroBee computer. It features 3-D point by point resolution graphics, shields, sound effects, intelligent objects, guided missiles, black holes and a score board. If you enjoy playing computer games, you will be captivated by Asteroids Plus.
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This secret code disassembler will disassemble any code sequence. Nothing is illegal. It will allow you to program with codes that no other disassembler can decipher!
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One of the most popular programmes ever released. This version was written especially for the Micro-Bee.
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A new language for the MicroBee. Comes complete with interpreter on one side of the tape and supporting programs on the other side. As well as this it includes a very well written, bound manual.
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PSYCHOTEC By Dreamcards
Psychotec provides a striking example of artificial intelligence, allowing a dialogue in English between computer and operator, the computer playing the role of psychiatrist and the operator being a "patient" on the couch. Leaves other "similar" types for dead.
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MERLIN By Dreamcards
Merlin is a 32K adventure set in England during the dark ages. Your task is to search through the dark forest inhabited by robbers, outlaws and creatures with awesome magic powers to find a legendary sword. An excellent adventure.
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Consists of a collection of modules which you may use to improve your own BASIC programs. They are all linked together under a menu driven display which allows you to RUN or LIST each module to see how they work.
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This program is designed to suit a wide range of records where indexing (and later searching) can be on one or two words, or on a string of up to 15 characters. Each record consists of its index heading, plus up to 12 lines of text. Each line can contain up to 41 characters.
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You are a tank running around a maze gathering all the supplies you can. It sounds easy, but you have a guided missile hot on your trail. Your only defence is a remote controlled mine which you drop and explode at will. A very fast joystick or key controlled game.
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PENETRATOR
A low resolution graphic version of the popular game "Scrambler". You must defeat the rockets and bomb the radars in an effort to get to the next stage which is even harder. This game can be either controlled by a Joystick or by keys. Being in Lores graphics it is a very fast game. If you are bored with the same land pattern you can devise your own.
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A lot like Penetrator but in high resolution graphics. You must battle your way through the various stages where at the last stage you have four chances of blowing up a neutron bomb shelter. If you are successful, the next round is a lot harder.
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Your mission is to rescue stranded astronauts. You are the commander of the Landing Module docked in space with the mother ship. It is your responsibility to guide the landing module through a meteor field, down to the surface of the planet, to land safely on a landing pad. An astronaut will then run to your landing module and you will blast off. You must use your lasers if necessary and dock with the mother ship again. A total of six astronauts must be shuffled to the mother ship.
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A fast action packed game which must rate as one of Mytek's best. You have full control of a helicopter and you must fly over enemy lines to rescue your allies. Fast realtsic graphics and excellent sound.
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A program to help you design your own P.C.G. characters. Simple commands allow easy drawing of circles, polygons and boxes etc. These then can be dumped to tape to be used in a future program. Comes complete with manual.
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PRINTERS MATE
This program is two screen dump programs to suit CP80, MX80, DT80, 80DP and FAX80 printers. One program is a screen dump utility while the other prints out memory contents in both hexidecimal and ASCII characters. A must for use with printers.
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DUO – ONE
Another two programs for the price of one from Dreamcards. One side has poker, and the other is Casino which is a three reel poker machine. Both use Hires graphics. Excellent value.
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EXTENDED TURTLE
A "Turtle" program which has been written by a teacher and has been several months in the writing. This is one of the best Turtle programs written and comes complete with a 40 page clearly written manual with many helpful drawings.
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DEFENDER – FROM MYTEK
This long awaited program is finally available. Defender needs no introduction. The Defender arcade game is one of the most popular ever produced and the Mytek version is brilliant, a rival for Asteroids Plus.
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DESTROYER
You are the UFO and you must destroy the enemy city buildings before you can land. You have no control over the UFO except for the three bombs on every pass you make over the city. But beware the UFO gets lower with every pass. Good graphics and sound.
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This program is another in the series of Physics simulations. The first part is a tutorial and the second is a simulation of the experiment.
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This game conforms exactly to that set down in the official rules of the International Backgammon Association, including the rules of doubling and scoring.
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POOLS AND LOTTO
Two programs to help make life easier for the Pools and Lotto enthusiast. The first program chooses your numbers for the week and the second program allows you to input your numbers into a program and when Lotto night arrives you can input the winning numbers and the computer will check your Lotto for you.
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This is the first tape in a series to assist students in grasping the fundamentals of geometric and technical drawing. It uses good graphics with excellent explanations.
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WESTERN DIGITAL SLASHES WINCHESTER CONTROL COSTS

A revamp of the WD1000-05 dropped its 100 piece price to under $250 plus tax. Looking very much like the WD179X floppy interface, the WD1000-05 will make engineers feel very much at home with an old friend. The 5¼" drive form factor and its drive signals are based on the Seagate ST506, ST412 and other compatible drives.

BELL 103 FSK MODEM CHIP — FIRST IN G.I. FAMILY

Designated AY-7-1203 General Instrument's CMOS. 300 baud full-duplex modem abounds with features such as digital filtering, power down mode, single 5V Rail, self test and echo suppress or inhibit tone facility. Later devices in the family will include CCITT V.21, CCITT V.23 (Modes 1 and 2) and Bell 202.

The AY-7-1203 will be in volume production early in 1984 and predictions are that the product will be very cost effective.

10 MBYTE "SKINNY WINNIE" CHALLENGES 5 MBYTE PRICING

Volume production and high yields have given Miniscribe Series III half height drives a considerable cost benefit edge over their rivals.

Miniscribe's Model 3012 not only saves space and money but power requirements are also reduced to around 17 Watts which is well under the industry average. This solves two problems — Start-up surge and ongoing thermal regulation.

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The Comx 35 — some promise there

Many designers play it safe when they set out to develop a product by sticking to the conventional lines. But Comx have taken some chances with a different BASIC and an 1802 microprocessor in their home computer. The 1802 would be virtually unknown but for its use in two eight-chip computers, the RCA VIP and the ETI-660. Nonetheless, they could have a winner, particularly amongst hobbyists.

Frank Rees

LAUNCHING a budget-priced home computer into today's extremely competitive market is a risky venture. Comx has apparently been clever enough to come up with what appears to be a well-designed little computer offering 32K RAM, colour graphics, sound, a 55-key keyboard, an inbuilt joystick and a unique dialect of BASIC which works well.

Ten programs are supplied with the computer, five of these are games and five are 'serious'.

The Comx plugs into an ordinary cassette player, with cables supplied. A disk drive and a printer are going to appear on the market shortly, according to the company.

The keyboard is calculator style, 'soft' keys, with what is basically a QWERTY layout of 55 keys. A robust joystick is built-in but all it does is generate key presses (136-139 for up, right, down and left) so that you can read it with the KEY function in BASIC.

The screen

The use of a UHF modulator and the inbuilt sound of the Comx 35 makes it compatible with both of the two major PAL television systems currently in use throughout the world. Austrlaia, like New Zealand, West Germany and some others, use the system employing a VHF tuner and a 5.5 MHz sound IF, while the UK uses a UHF tuner and a 6.5 MHz sound IF.

If you are contemplating the addition of a video outlet for a black and white monitor, then the Comx's inbuilt sound is very handy. However, at present, it means that you not only have to have a colour TV with a UHF tuner, but also need some modifications to your set if you don't have channel 5A on your VHF tuner.

When UHF tuners were first fitted to colour TVs, the VHF tuners often did not have the extra position 'U' for the UHF ▶

Comx 35

front end which converted the UHF signal to a VHF signal to be received by the VHF tuner. Many sets had the channel 5A position marked 'U' but the UHF front end was actually packed in a plastic bag at the back of the set. It is fortunate that I am a TV technician because mine was one of these and I had to make the necessary modifications to the set.

Once the Comx is plugged into the TV, it produces a stable 40 x 24 line eight-colour display with 128 different characters available. Lower case isn't standard, but if you wanted it, the SHAPE command can easily redefine the whole set. This is about it as far as graphics are concerned — there are no pixel or bit-mapped high resolution graphics.

The colour partially compensates for this. Comx BASIC will put your typing up in one colour and the response up in another, which is quite helpful. Eight background colours and 12 character colours are available to make fast multi-coloured displays.

The sound is very simple, consisting of a single note channel opened at any of eight octaves with MUSIC or TONE and white noise controlled by NOISE. Fortunately VOLUME control is available as the sound can be very loud.

The 1802 processor, etc.

The 1802 is a CMOS eight-bit chip equipped with a well-ordered instruction set and plenty of 16-bit registers. It is backed up by a set of three RCA support chips — the 1869, 1870 and 1871, for screen, input/output, sound and other functions. The rest of the computer is a bank of 32K RAM and another block of 3K RAM which gives you 35K and hence the Comx 35 it's name.

There must have been good reasons for the manufacturers to select the 1802 microprocessor for the Comx 35. Although it is easy to raise objections about available machine code routines and programs, and the shortage of programmers experienced in 1802, so far the software made available by Comx looks good, and an independent supplier is already advertising programs for it.

The 1802's structure lends itself to use by the hobbyist with only a simple monitor program, instead of an assembler with all the trappings. However, with a 35K memory and the 1802's tidy structure, I'm sure a basic assembler will become available soon. The clean, tidy logic of 1802 will appeal to many as an introduction to machine language, as well as to those who want to learn it as a way of extracting maximum performance from their computers.

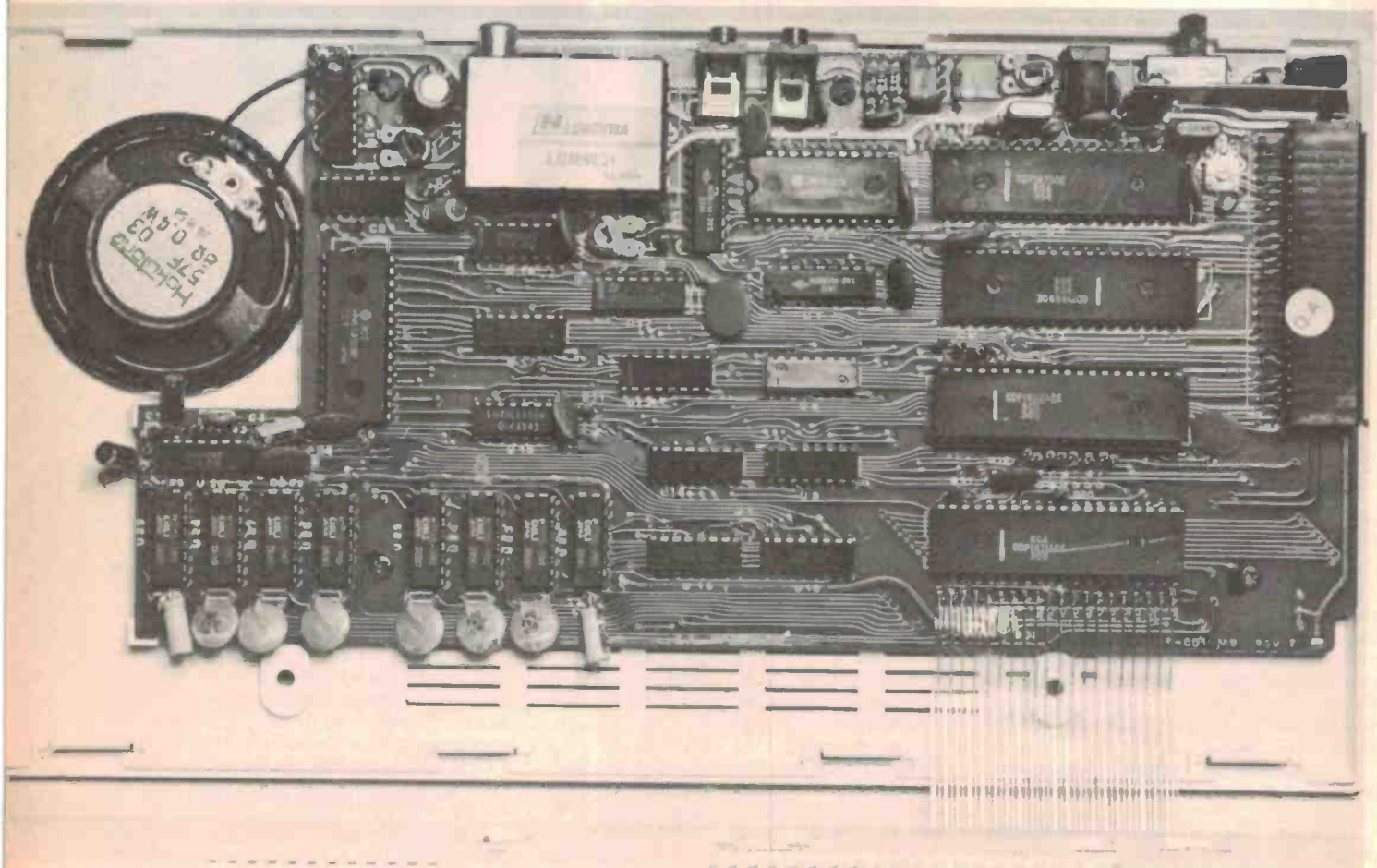
Machine language is supported by a full array of BASIC instructions and has the ability to handle hex numbers without messy conversions. This is really important in a 35K computer, as the use of decimal numbers over 32767 (7FFF hex) would require additional conversion to two's complement expressed as a negative number (yuk).

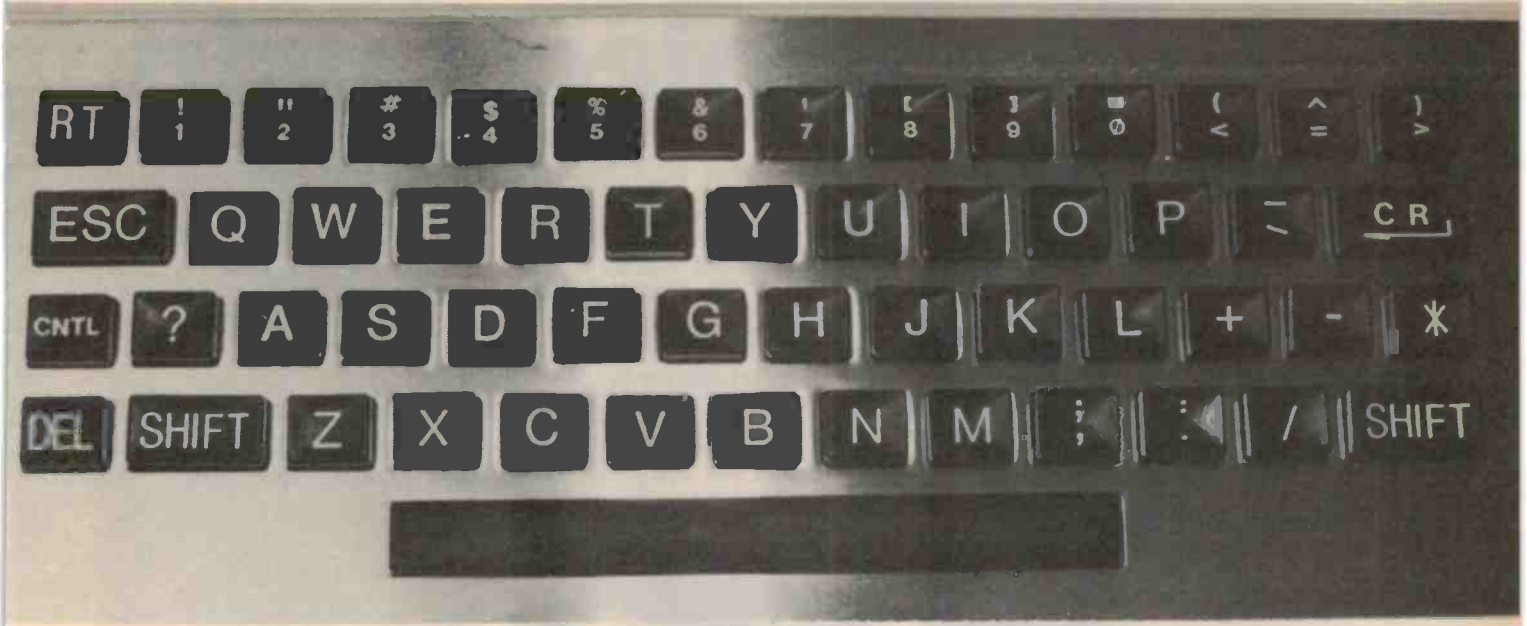
As a user of machine language, I found the Comx system really geared towards making machine language an easy-to-use, integral part of BASIC.

Comx BASIC

The BASIC is fairly impressive, especially considering that 1802 BASICs are rare and Comx had to write their own. I think they've been very successful. Some of the common BASIC commands have been changed for a variety of reasons. 'INKEY$' has been changed to 'KEY' because it is the numerical code input of the key pressed, rather than the character itself. D for DATA and P for PROGRAM prefixes 'SAVE and LOAD' memory to, or from, cassette instructions. Besides MUSIC, TONE and VOLUME, the sound instructions include NOISE which forms an important part of realistic sound effects.

On the inside. There's not much to it these days! RAM located at lower left, keyboard interface at lower right. The expansion interface connector can be seen at far right, RF modulator at middle upper part of the pc board. The tape input/output sockets are to the right of the modulator.





Keyboard closeup. The keyboard is more or less the standart QWERTY layout. 'Rubber' keys are used but they're firmer than the usual ones seen on most other machines about, and the keys are concave sculpted, which is definite help. It's a wise idea to hit the space bar in the middle for reliable operation.

A RUN+ statement converts literal GOTO destinations into absolute addresses i.e: it does time consuming branch calculations first. This speeds up the already fast BASIC. TIME starts an internal interrupt timer. When it reaches zero, the BASIC GOSUBs to the routine specified by TIMOUT. Timed interrupts allow you to play a tune under program control with a game under way at the same time.

Other new or changed BASIC commands are:

SCREEN	sets background to one of eight colours.
COLOUR	sets characters to one of twelve colours.
CPOS	sets cursor to position X,Y.
CTONE	sets the character to the same colour as the background but brighter than it.
EOD	gives hex address to end of data.
EOP	gives hex address to end of program.
EXIT	to exit a for/next loop.
EXP	exponent e.
FIXED	fixes number of decimal places.
FNUM	rounds numerical expression and converts to floating point.
FORMAT	specifies field width of numbers.
DEFUS	defines USR program start location.
FVAL	evaluates numbers in string and is unique to the Comx.
INUM	force function to integer mode.
KEY	'no wait' key input numerical (ASCII) code value.
MOD	function module.
MUSIC	a music note set for frequency and amplitude.
VOLUME	programs the sound level.
WAIT	simpler than a FOR/TO for delay.
RENUMBER	tidies up line numbers of a patched program.
RUN+	speeds up program running by doing time consuming branch calculations first.
SHAPE	generates your own character or graphic shapes.
TRACE	used to debug by showing line number on screen as executed.
MID$	serves as LEFT$ and RIGHT$
JOYSTICK	the four-position switch types are read like keys.
TIME	sets timer
TIMOUT	command performed when timer zeros

Editing is an old-fashioned serial line editor invoked by EDIT. The cursor is positioned underneath the point you want to change and by typing I, D or C, it will be either inserted, deleted or changed by control S.

The owners manual is better than most, and I suspect that if I used it enough, I would find it a reference that I'd want to keep. However, I'm sure beginners would need more than the manual before they could use the Comx.

PAL and NTSC graphics can be different, so if you write programs to submit to the 'Comx International Users Club', leave out line 9 of the graphic SHAPE command because this can only be reproduced on the PAL system.

Summary

The Comx 35 has something different to offer, is low-priced and works according to expectations. It has some promise if you want to get into machine code and the 1802 microprocessor is good for learners in that respect. The BASIC in the Comx 35, while different, is at least 'friendly'. ●

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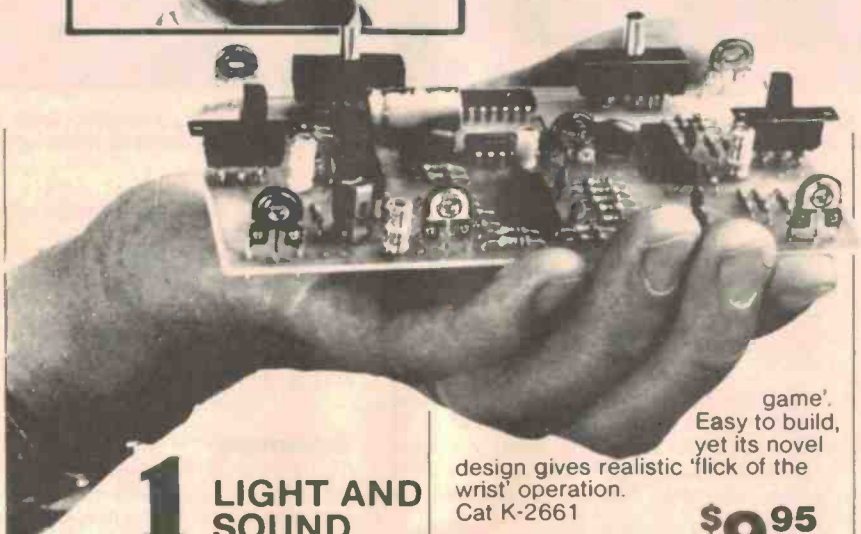

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Put this project in a quiet, dark place, and it starts chirping; turn on the light or make a noise, and it stops! Infuriating - just like a real Nocturnalis Stridulus Gryllidae (Cricket to you). Cat K-2663

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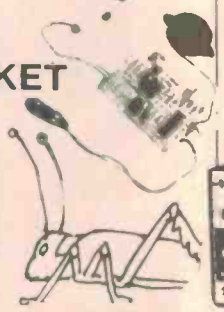

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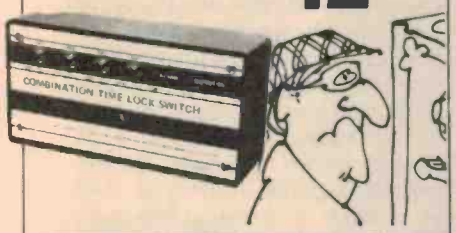

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* Please note: all projects shown with optional cases. The labels shown are all printed in the Fun Way 3 book.

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See page 117 for full adress details.

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ONE COMPUTER BOTH 8

AUSTRALIAN COMPANY HAS MORE TO OFFER THAN INTERNATIONALS

THERE are a number of flaws in assuming that large international companies can provide a better product. In particular some Australian companies are able to provide support not matched by the "big guns" such as IBM, Apple, and Digital Corp. When phoning an IBM service centre can you speak directly with the people that designed the machine? Acoustic Electronic Developments, known nowdays as AED COMPUTERS have displayed an uncanny ability to provide superior product technology as well as service unsurpassed in the industry.

JUMP FROM PROGRAM TO PROGRAM — First for Australia

Previously CP/M-based microcomputers were only able to run one program after the other, resulting in their inability to reach full potential in minute-to-minute business activities.

Analysing small busineses it becomes apparent that businessmen are required to swap randomly from function to function. One moment they are production controllers, the next sales persons, next the accountant, etc. By the very nature of office life they seldom finish one task before being interrupted by one more urgent.

The microcomputers inability to rapidly swap from function to function has been overcome by a revolutionary new operating system concept (MPS Multiple Program Selection) developed by AED. At a touch of the keyboard the current task is saved in suspended animation. The user then selects one of nine other tasks, which complete with its screen image, is loaded into the computer and released. The swap takes only six seconds (about 20 times faster than conventional systems). When done with the new task the operator returns instantly to the original.

Swapping programs on conventional microcomputers is slow, requires many keystrokes, and normally there is no menu prompting. MPS, however, is extremely fast, requires only three keystrokes, and is completely menu assisted. Other attempts have been made to solve this problem by creating a fully integrated suite of programs. This approach yields an improvement though still suffers slow swap time and only specially written programs are available for the system. MPS resides in the operating system, therefore offers extreme speed and is compatible with any standard CP/M program.

SUPERAED — The CP/M your having when your not just having CP/M

In the first two years of manufacturing microcomputer systems AED became aware of many features that were not provided by the popular CP/M operating system. This shortcoming was holding back microcomputers from reaching their full potential in business, office automation and engineering applications.

Analysing alternative operating systems revealed that some had advantages in some areas but still lacked the end-user oriented features that were of primary concern. It appears that computer system programmers give total priority to hardware, disk file structures, programmers facilities, and the command power to impress engineers and technicrats. This explains why these operating systems, while more powerful, still lack the basic facilities that would make the computer infinitely more useful to the businessman, engineer, doctor, etc., that use it from day to day.

Solving this problem by designing a new op-system was due to the incredible software base available for CP/M. Other company's CP/M look-a-likes all have compatability problems and AED didn't want to join the list. The alternative of developing an extension package to CP/M was adopted with some startling results, all achieved without corrupting one byte of CP/M or it's CCP.

After 12 months in development AED released SUPERAED which was an immediate success leading to increased sales of the "AED SUPERCOMPUTER I" and drew considerable interest overseas. After a further 18 months development a new version with a unique multiple program selection capability (MPS) was released, along with a new computer "AED UNIVERSE Supercomputer II" which combined 8 & 16-bit operation in one machine.

Superaed provides many features unique to a CP/M-based system including:

Intelligent Terminal Driver. A special driver for the extremely fast AED UNSERIAL terminal, providing display speed control and intelligent software control over cursor and all screen characteristics.

Keyboard Substitution. Allowing application software to talk to the computer as though it were the operator. At last one program can use another to participate in the job at hand.

Automatic background memory testing. SUPERAED continuously scans the computers memory, warning the operator of any faults before they cause subtle data errors to creep into your files.

Selection of multiple printers. CP/M provides for only one printer. "SUPERAED" provides for 8 printers which may be selected directly from the keyboard or under software control. Orders can be automatically directed to a printer loaded with order forms, invoices to a printer with invoice forms, etc.

A powerful diagnostic monitor. This is one of the most startling features of "SUPERAED". Unlike other systems the monitor can be entered even when a CP/M program is in use. After using the monitor for diagnostics, experimental, or debugging purposes, you can return right back to the CP/M application. At last you can look deep into the software and hardware system of your computer while the sample is still under the microscope.

OPERATING SYSTEMS — TO GO

The majority of microcomputer systems have either 8-bit 8080, 8085, or Z80 CPUs or 16-bit 8086 or 8088 CPUs. The CP/M operating system has been adopted internationally as the standard for 8-bit machines. CP/M-86 and MS-DOS operating systems share the market for 16-bit machines. Owners of 8-bit machines are limited to 8-bit CP/M software of which there is an abundant variety. Owners of the technically superior 16-bit machines have access to a respectable, yet somewhat more limited variety of software. Choosing which machine to buy can become a nightmare when weighting-off performance, software availability, and the future. The AED UNIVERSE computer simplifies this choice offering the best of both worlds. By employing a software selectable dual 8 & 16-bit CPU the UNIVERSE can run all of the most popular operating systems: CP/M, MP/M, I/OS, Multi/OS, CP/M-86, MS-DOS and more to follow. This approach opens the door to a wide application software range than almost any other computer system. AED are planning to release

& 16-BIT

additional bus master CPUs such as 68000, 16032, and 80286, extending even further the range of operating systems available.

HARDWARE — Built for speed and expandability

The AED UNIVERSE electronics is based on a 20 slot IEEE 696 S100 bus structure. This is the only bus endorsed by an international standards organisation. There are many systems that claim compatability with this standard but beware as compatability with and compliance to IEEE 696 mean two different things. An S100 system has many advantages over integrated proprietory systems as it offers greater expandability as products are available from a broad range of vendors. S100 tends to be the first to introduce new technology in a practical form and offers the greatest performance cost ratio.

The universe uses a dual 8 & 16-bit CPU which boasts the highest clock speeds available, that is 6MHz on the 8-bit and 8MHz on the 16-bit. The systems memory cards work in both the 8-bit and 16-bit modes making extension of the system to future 16-bit and 32-bit processors viable. The UNIVERSE employs intelligent Direct Memory Access (DMA) temporary bus master floppy and hard disk controllers employing there own processors to remove burden from the system CPU. This technique yields speed far exceeding systems from the large corporations.

Printer and communications input and output are handled by what must be the most powerful I/O system ever offered on a microcomputer system. This card has its own on board Z80 CPU combined with 256K-bytes of memory to dynamically buffer all input and output from the two centronics and two programmable serial ports. The card also boasts a clock calendar, programmable interrupt system, programmable counter timers, and a unique power supply monitoring system.

The UNIVERSES terminal is part of the computers main memory system making it several times faster than conventional serial terminals. In fact, the UN-SERIAL terminal is so fast that under WORDSTAR word processing software the UNIVERSE performs more like a sophisticated dedicated word-processor than a normal computer.

SUPPORT more the merrier

Engineering and service support for AED systems is second to none in the industry. Phoning an AED sales and service centre puts you in contact with engineers rather than salesmen. Usually the engineer was involved in one or more aspects of the machines electronic or operating system design. Few if any multi-nationals can offer this ready access to engineering support. AED has chosen as agents, engineering companies involved in sales instead of sales companies involved in engineering and provide complete engineering service and sales support in Sydney, Melbourne, and Canberra, and intend to soon include Brisbane, Adelaide, and Perth.

AED can provide complete System analysis and consultancy. SOFTAED a Sydney-based division of AED produces custom written applications where off-the-shelf software is not suitable. AED installs the systems and provides any necessary training.

Service contracts are available covering most of NSW and Victoria. AED were one, if not the first computer company in Australia to provide a one-year warranty, a true reflection of the reliability of the machines and the companies belief in them.

RS232-to-Centronics interface

Geoff Nicholls

Most microcomputers worth owning have an 'RS232' connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel 'Centronics' interface printers. Save some money, build this interface.

WHILE I designed and constructed this project to drive an Admate or TI 850 80-column dot-matrix printer from the lab. Microbee, it is 'universal' enough to suit any application requiring an interface between an RS232C port and a Centronics interface.

Printers with a parallel, or 'Centronics', interface are around $80 to $150 cheaper than with a serial, or RS232C, interface. However, the 'default' printer output on most microcomputers is via the serial interface and a serial interface printer is assumed when LLISTing or LPRINTing from BASIC. This project can be constructed for considerably less than the difference between the cost of a printer with a serial or a parallel interface.

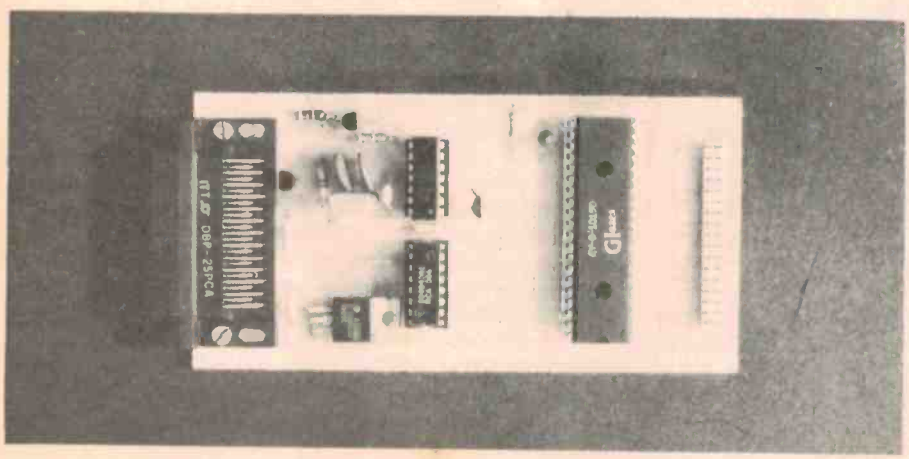
Features

The project simply plugs directly between the computer's RS232C socket and the printer's Centronics connector. It is powered from the +12 V line on the RS232C interface. It is preset to operate at a speed of 1200 baud, but provision has been made for selectable baud rates of 300, 600, 2400 and 4800 (depending on choice of one IC), in addition to that. The data format is also preset, to eight data bits one stop bit/even parity, but other formats can be selected. Tracks etched on the pc board preset the speed and data format, but provision has been made to use either links or DIL switches.

The interface is built around a single supply rail UART ('universal asynchronous, receiver-transmitter) from General Instruments, the AY-3-1015D. This chip pretty well does the whole job, even supplying the acknowledge signal (handshake) for the RS232C port. A 4.9152 MHz crystal is divided down to provide baud rate clock outputs. Either of two IC types can be used here — a 4020B or a 4040B. The 4040B provides only the lower three baud rates (300, 600 & 1200) while the 4020B provides the full complement. However, whichever type is used, it must be capable of running at 5 MHz on a 5 V supply. The minimum speed spec. for Philips and Fairchild devices equals this, but it is lower for National Semiconductor devices — though some chips may run at this speed.

Construction

Assembling the project is quite straightforward. However, there are a few points to watch. Firstly, whether you're using a ready-made pc board or have etched your own, check that all the tracks are intact and that there are no bridges, particularly where tracks run between IC pins. Also see that all the holes are drilled correctly. ▶

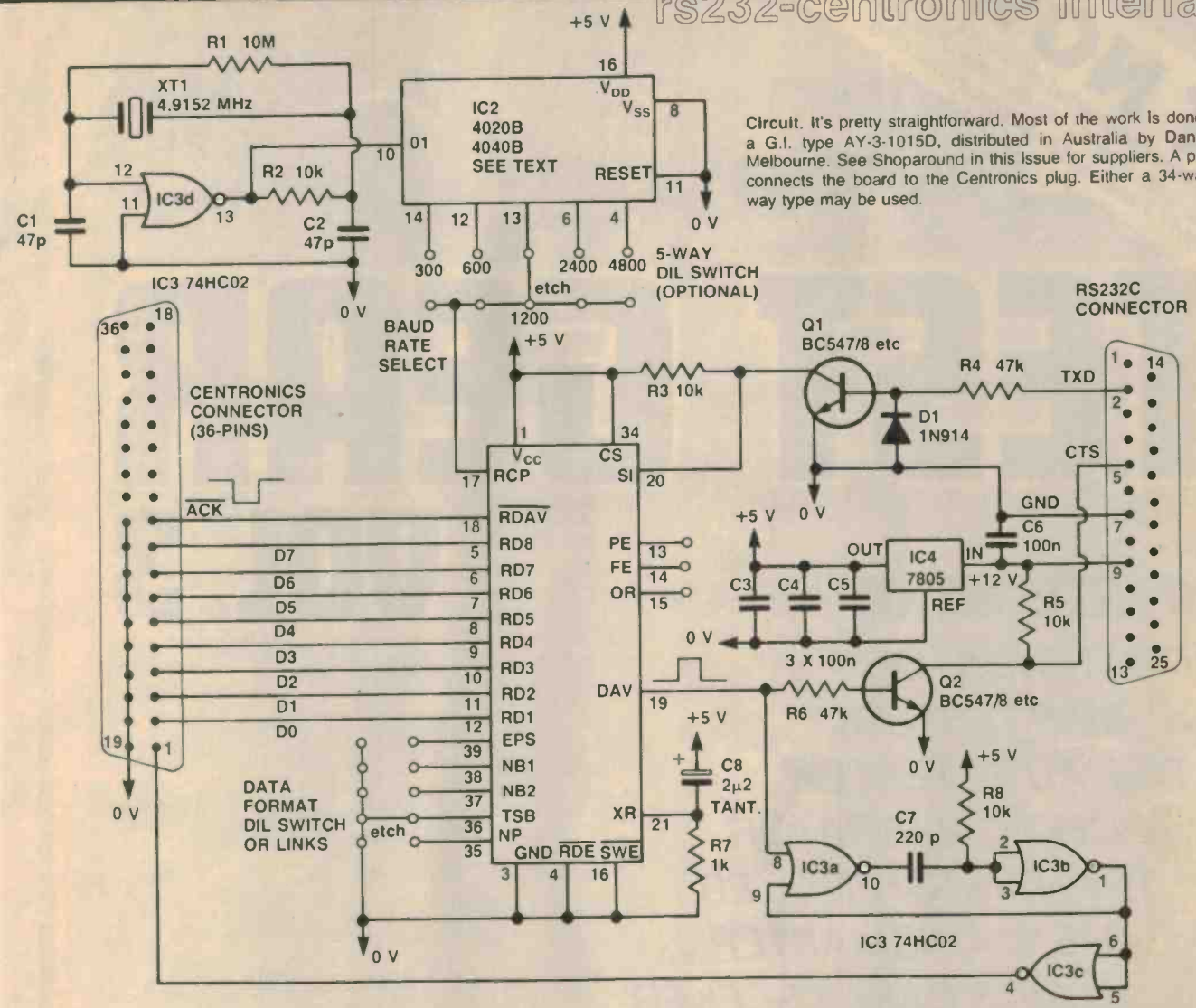


Plug in and go. There's not much to this project. The prototype here is configured to plug straight into a Microbee, but the project's suitable for any micro with an RS232C port.

HOW IT WORKS ETI-675

Most of the circuitry in the interface is inside IC1, a universal asynchronous receiver/transmitter, or UART. I have only utilised the receiver section, hence the large number of unused pins. Serial data enters the UART on pin 20 after being inverted and level shifted by Q1 to convert from RS232 voltages to TTL levels. When a complete word has been received the Data Available line (DAV) goes high, indicating that the word is ready to be read out. The DAV low-to-high transition triggers the monostable made from IC3 a, b, c. This generates the Data Strobe signal for the Centronics cable. The DAV signal also drives the Clear To Send (CTS) line on the RS232C side via inverting buffer Q2. This inhibits any further characters from the sending device (i.e: Microbee) until the printer has read the last one sent. When the printer is ready for another character it momentarily lowers the ACKnowledge line on the Centronics cable, which resets the DAV line via the UART input RDAV. This returns CTS to the high voltage and we are back where we started, ready to receive a new character.

The baud rate clock comprises IC3d, a standard crystal oscillator using a high speed CMOS gate, and IC2, a multistage divider. The divided outputs are brought to a



Circuit. It's pretty straightforward. Most of the work is done by IC1, a G.I. type AY-3-1015D, distributed in Australia by Daneva from Melbourne. See Shoparound in this issue for suppliers. A pin header connects the board to the Centronics plug. Either a 34-way or 36-way type may be used.

pad array, which can be used with a 5-position DIL switch to change rates if you wish. The PC board is etched to only use 1200 baud, so that Microbee users need not change anything.

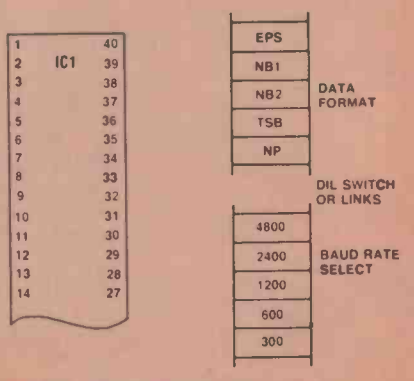
Either a 4020B or 4040B can be used for IC2, but the highest two baud rates will be different (1200 baud is unaffected). The overlay shows the rates for a 4020B i.e: 300, 600, 1200, 2400 and 4800 baud. If a 4040 is used then the lowest three rates will be the same but extra links will have to run to get 2400 and 4800 baud, owing to the different pinouts.

IC2 must be able to run with a 4.9 MHz clock at 5 V, which is slightly faster than the typical spec. for National devices, but is the minimum spec. for Fairchild or Philips (HEF4020B, HEF4040B). The symptom of a slow device is that the first stage divides by three instead of two, so look at pin 9 with a counter to make sure all is well.

The CR network of C8 and R7 reset the UART on power-up while IC4 and associated components develop the +5 V rail from the RS232C's positive supply. The pads near pins 35-39 of the UART set up the parity and bit length of the serial conversion, they are preset by board tracks to suit the Microbee.

OPTIONAL DIP SWITCHES

The PC board has been laid out to allow the option of fitting two 5-way DIL switch banks, between the UART and ICs 2 and 3. This allows the selection of different baud rates, parity and stop bits. The PC board comes with tracks etched to set eight data bits, one stop bit, no parity bit and 1200 baud. These suit most uses, but if you want to run some other combination then you will have to cut the two tracks and install wire links or DIL switches. The signal definitions are as per the diagram here and Table 1.



NOTE THAT YOU CAN ONLY GET 2400 AND 4800 BAUD WHEN USING THE 4020B FOR IC2

TABLE 1

SIGNAL	FUNCTION		
EPS	ON — ODD PARITY	OFF — EVEN PARITY	
NB1, NB2	NUMBER OF BITS PER CHARACTER		
	NB2	NB1	BITS
	ON	ON	5
	ON	OFF	6
	OFF	ON	7
	OFF	OFF	8
TSB	ON — 1 STOP BIT	OFF — 2 STOP BITS	
NP	ON — NO PARITY	OFF — PARITY EXPECTED	

Only one switch in the baud rate bank may be on at one time, otherwise improper operation will occur.

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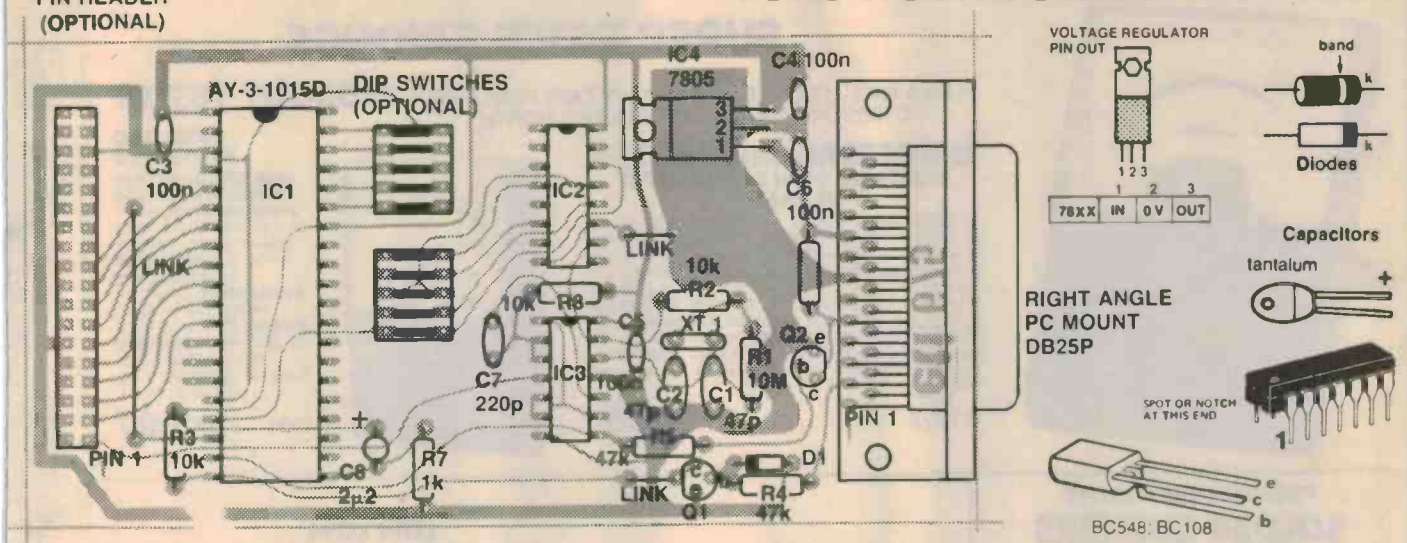


PARTS LIST — ETI-675

Resistors ..... all ¼W, 5%
- R1 ..... 10M (10% OK)
- R2, 3, 5, 8 ..... 10k
- R4, R6 ..... 47k
- R7 ..... 1k

Capacitors
- C1, C2 ..... 47p NPO ceramic
- C3, 4, 5, 6 ..... 100n 'bluechip' ceramic
- C7 ..... 220p ceramic
- C8 ..... 2µ2/6 V tantalum

Semiconductors
- IC1 ..... AY-3-1015D (G.I.) or exact equiv.
- IC2 ..... 4020B or 4040B (must run at 4.9 MHz on 5 V supply)*
- IC3 ..... 74HC02
- Q1, Q2 ..... BC547, BC548 etc.
- D1 ..... 1N914

Miscellaneous
- XT1 ..... 4.9152 MHz crystal, HC18/U

ETI-674 pc board; right angle pc mount DB25 plug; 34-way pin header (0.1 x 0.1") — optional; 34-way female IDC plug (optional); IDC Centronics plug (if required); 34-way ribbon cable; two 5-way DIL switches (optional); etc.

Price estimate: $28-$58

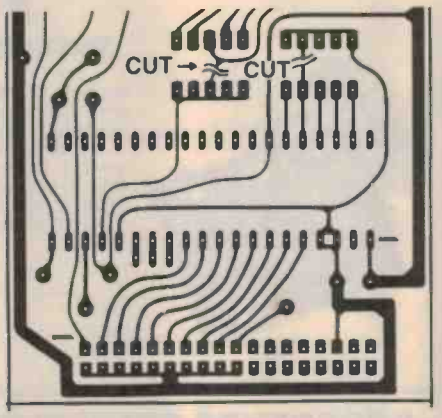
*Philips HEF4020B/HEF4040B and Fairchild 4020B/4040B known to work.

Solder all the resistors and capacitors in place first. Make sure you get the tantalum capacitor (C8) the right way round. Next solder D1 in place, making sure you get it the right way round, too. Follow with the two transistors, Q1 and Q2.

Solder the three links in place next, followed by the three IC sockets and the crystal. The three-terminal regulator (IC4) can be soldered in now. Note that a heatsink is not required for it. If you are using DIL switches for baud rate and data selection, these should be soldered in place next.

Last of all, solder the 34-pin header strip and DB25P right angle connector in place. The latter should be bolted to the board firmly before soldering so that no stress is placed on the solder joints. Insert the ICs now. The UART is an NMOS device, while the other two are CMOS. Take the usual precautions against static damage.

Make up interconnecting cables to suit your individual requirements (see next section). If you're using a Centronics plug, I strongly recommend you use an insulation displacement type as the solder pin type is much harder to assemble, with a chance of errors and poor connections.



A cut above. To obtain other baud rates and data formats, the two tracks marked above must be cut. Links or DIL switches can be used to select the required configuration.

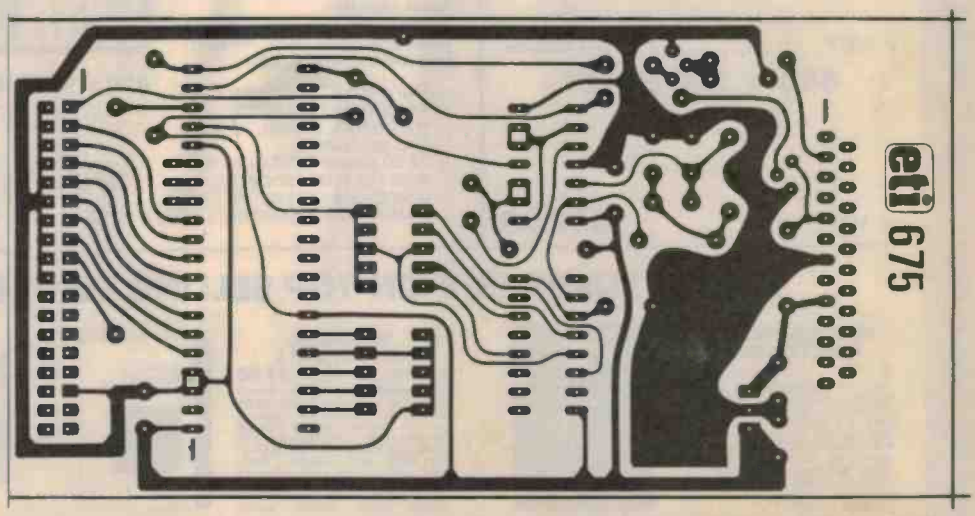
Mounting

Actual mounting details are left up to you, as requirements will vary widely. The board can be mounted inside your printer, in which case the DP25P plug and 34-pin header may be dispensed with and the board wired-in directly. Alternatively, the board may be mounted inside a zippy box, or other suitable case, and cables wired to it with suitable connectors on the end. Or, if you have a Microbee, you can do as I did and plug it straight in to the DB25 socket on the rear of the cabinet and let it hang out the back. A couple of 'feet' might be useful, though. These could consist of two standoff pillars with rubber grommets attached, bolted to the end of the board either side of the 34-pin header. The overall price of the project depends on the connectors and case used — or not used.

Using it

With a Microbee, just plug it in and go! With other micros, setting the baud rate and data format is simply a matter of cutting the two tracks (as indicated in the diagram here) and either installing links or DIP switches and linking the appropriate outputs across as per Table 1.

Happy LLISTing! ●



Board artwork. Full-size reproduction of the pc board. ▶

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ONE ARM BANDIT

R.T. Webb, Canterbury NZ

This program is of a one-arm slot machine using PCG graphics.

When I was writing this program I found that there was a problem between the plot commands and the poked PCG characters. To overcome this interaction I first plotted the machine and calculated the PCG used which was 102. I then poked my characters in at 63488 + 103 * 16. This solved the problem.


```
00100 HIRES:SPEED 0:POKE 220,60:DIM Q1(4)
00110 CURS 205:PRINT "******    ONE ARM BANDIT    ******"
00120 CURS 282:PRINT "R.T.WEBB."
00130 CURS 344:PRINT "KAIAPOI. N.Z."
00140 CURS 523:PRINT "YOU HAVE $50 AT THE START OF THE GAME":CURS 663:PRINT "$1
for each try"
00150 CURS 906:PRINT "IF YOU WISH TO ABORT PROGRAM PRESS KEY S"
00160 PLAY 24;16;24;16;24;16;12;4;12;4;12;4;12;4;12;4
00170 S=0:P=63488+103*16
00180 FOR A=P TO P+16*24-1
00190 READ B:POKE A,B
00200 NEXT A
00210 IF S=1 THEN GOTO 470
00220 CLS:L=1
00230 FOR Y=1070 TO 1100 STEP 10
00240 X=2:GOSUB (Y):PLAY 24:X=X+6:GOSUB (Y):PLAY 24:X=X+6:GOSUB (Y):PLAY 24:X=X+
6:GOSUB (Y):PLAY 24:X=X+2:PRINT "   PAYS $10"
00250 L=L+2
00260 X=2:GOSUB (Y):PLAY 10:X=X+6:GOSUB (Y):PLAY 10:X=X+16:PRINT TAB(X) "PAYS $2
"
00270 L=L+2
00280 NEXT Y
00290 CURS 104:PRINT "   $1 A TRY"
00300 CURS 744:PRINT "ALL OTHER "
00310 CURS 808:PRINT "COMBINATIONS"
00320 CURS 872:PRINT "LOSE"
00330 FOR I=1 TO 2000:NEXT I
00340 HIRES:PLOT 125,185 TO 283,185 TO 283,150 TO 125,150 TO 125,185
00350 PLOT 123,187 TO 285,187 TO 285,148 TO 123,148 TO 123,187
00360 PLOT 123,187 TO 103,207 TO 265,207 TO 285,187
00370 PLOT 103,207 TO 183,217 TO 345,217 TO 265,207
00380 PLOT 123,158 TO 123,118 TO 285,118 TO 285,187
00390 PLOT 123,118 TO 96,58 TO 258,58 TO 285,118
00400 PLOT 265,58 TO 345,98 TO 345,217
00410 X=103:FOR I=1 TO 17:X=X+9:PLOT X,207 TO X+18,187:NEXT I
00420 X=126:FOR I=1 TO 51:X=X+3:PLOT X,145 TO X,122:NEXT I
00430 PLOT 139,179 TO 269,179 TO 269,156 TO 139,156 TO 139,179:PLOT 171,176 TO 1
71,159 :PLOT 203,176 TO 203,159:PLOT 236,176 TO 236,159
00440 PLOT 139,179 TO 123,187:PLOT 269,179 TO 285,187:PLOT 269,156 TO 285,148:PL
OT 139,156 TO 123,148
00450 CURS 16,11:PRINT [A18 47]:CURS 17,10:PRINT [A18 47]:CURS 15,12:PRINT [A18
47]
00460 CURS 465:PRINT " * B A N D I T * "
00470 PCG:CURS 338 :PRINT"ghi":CURS 342:PRINT "jkl":CURS 346:PRINT"mno":CURS 350
:PRINT"pqr":CURS 359:PRINT "vw":CURS 423:PRINT "xy":CURS 487:PRINT "z{":CURS 551
:PRINT "|}~":NORMAL
00480 CURS 10:PRINT "Press any Key to pull the handle"
00490 W1=50
00500 REM
00510 CURS 940:PRINT "YOU HAVE $";W1;" "
00520 A1$=KEY$:IF A1$="" THEN GOTO 520
00530 IF A1$="S"OR A1$="s" THEN GOTO 1150
00540 W1=W1-1
00550 CURS 896:PRINT "
00560 CURS 940:PRINT "YOU HAVE $";W1;" "
00570 FOR V=1 TO 20
00580 PCG:CURS 338:PRINT"stu":CURS 342:PRINT "ust":CURS 346:PRINT"tus":CURS 350:
PRINT"stu"
00590 CURS 338:PRINT "tus":CURS 342:PRINT "stu":CURS 346:PRINT "ust":CURS 350:PR
INT "tus":NORMAL
00600 REM PLAY 1
00610 NEXT V
00620 REM
00630 B=338:FOR V=1 TO 4:Q1(V)=0:NEXT V
00640 FOR V=1 TO 4
00650 C=INT(RND*4)+1
00660 PCG
00670 IF C=1 THEN CURS (B):PRINT "ghi":Q1(V)=1
00680 IF C=2 THEN CURS (B):PRINT "jkl":Q1(V)=7
00690 IF C=3 THEN CURS (B):PRINT "mno":Q1(V)=15
00700 IF C=4 THEN CURS (B):PRINT "pqr":Q1(V)=21
00710 IF V=1 THEN CURS 342:PRINT "stu":CURS 346:PRINT "ust":CURS 350:PRINT "tus"
00720 IF V=2 THEN CURS 346:PRINT "stu":CURS 350:PRINT "stu"
00730 IF V=3 THEN CURS 350:PRINT "ust"
00740 NORMAL:LET B=B+4
00750 NEXT V
00760 REM
00770 T1=Q1(1)+Q1(2)+Q1(3)+Q1(4):S1=Q1(1)+Q1(2)
00780 REM
00790 IF T1=4 OR T1=28 OR T1=60 OR T1=84 THEN GOTO 1110
00800 IF S1=2 OR S1=14 OR S1=30 OR S1=42 THEN GOTO 1120
00810 IF W1<1 THEN GOTO 1130
00820 GOTO 510
00830 DATA 0,127,112,104,103,102,102,127,127,102,102,103,104,112,127,0
00840 DATA 0,255,0,0,255,129,66,60,60,66,129,255,0,0,255,0
00850 DATA 0,254,14,22,230,102,102,254,254,102,102,230,22,14,254,0
00860 DATA 0,124,6,3,65,32,16,127,127,16,32,65,3,6,124,0
00870 DATA 0,24,24,24,165,231,60,255,255,60,231,165,24,24,24,0
00880 DATA 0,62,96,192,130,4,8,254,254,8,4,130,192,96,62,0
00890 DATA 0,126,102,102,102,102,102,102,102,102,102,102,102,102,126,0
00900 DATA 0,66,126,24,24,255,255,0,0,255,255,24,24,126,66,0
```

NO NAME GAME

Llew Ashdown Camira Qld

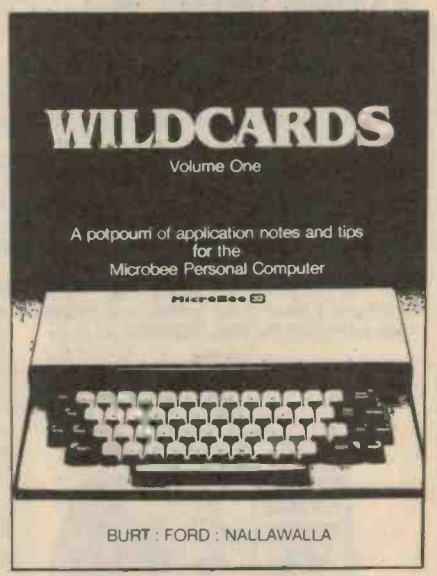
I came up with this short routine while attempting to write a graphics orientated game for the kids. It's guaranteed not to crash and even a four years old child can play it happily.

The controls are: 'P' up; 'L' west; ';' east; '.' down; '(space bar)' halt.

NO NAME GAME

```
00100 CLS
00110 LORES
00120 A=INT(RND*120)+1
00130 B=INT(RND*45)+1
00140 INVERT A,B
00150 A1$=KEY$:IF A1$=""THEN 150
00160 IF A1$=";" THEN 220
00170 IF A1$="P" THEN 290
00180 IF A1$="." THEN 430
00190 IF A1$="L" THEN 360
00200 IF A1$="N" THEN 100:REM NEW GAME
00210 GOTO 150
00220 IF A>126 THEN 150
00230 A=A+1
00240 A2$=KEY$:IF A2$=" "THEN 150
00250 INVERT A,B
00260 FOR S=1 TO 50 :NEXT S
00270 IF A>125 THEN 150
00280 GOTO 230
00290 IF B>46 THEN 150
00300 B=B+1
00310 A3$=KEY$:IF  A3$=" "THEN 150
00320 INVERT A,B
00330 FOR F=1 TO 100 : NEXT F
00340 IF B>45 THEN 150
00350 GOTO 300
00360 IF A< 1 THEN 150
00370 A=(A-1)
00380 INVERT A,B
00390 A4$=KEY$:IFA4$=" "THEN 150
00400 FOR C=1 TO 50 :NEXT C
00410 IF A<2 THEN 150
00420 GOTO 370
00430 IF B< 1 THEN 150
00440 B=(B-1)
00450 INVERT A,B
00460 A5$=KEY$:IF A5$=" "THEN 150
00470 FOR D=1 TO 100 :NEXT D
00480 IF B<2 THEN 150
00490 GOTO 440
```

```
00910 DATA 0,126,102,102,102,102,102,102,102,102,102,102,102,102,126,0
00920 DATA 0,120,72,120,7,7,7,0,0,7,7,7,120,72,120,0
00930 DATA 0,60,60,60,129,129,255,102,102,255,129,129,60,60,60,0
00940 DATA 0,30,18,30,224,224,224,0,0,224,224,224,30,18,30,0
00950 DATA 0,72,0,73,73,0,36,0,73,0,0,34,0,0,65,0
00960 DATA 0,65,0,8,33,0,0,37,37,37,0,0,68,0,17,0
00970 DATA 0,36,0,65,0,0,34,0,73,0,64,0,146,146,146,0
00980 DATA 63,63,41,41,63,9,9,9,63,41,41,63,9,9,9,127
00990 DATA 255,255,37,37,255,36,36,36,255,37,37,255,36,36,36,255
01000 DATA 127,3,3,3,3,3,3,3,3,3,3,3,3,3,3,3
01010 DATA 255,240,240,240,240,240,240,240,240,240,240,240,240,240,240,240
01020 DATA 3,3,3,3,3,3,3,3,3,3,3,3,3,3,3,3
01030 DATA 240,240,240,240,240,240,240,240,240,240,240,240,240,240,240,240
01040 DATA 3,3,3,3,3,3,3,3,31,48,96,192,192,96,48,31
01050 DATA 240,240,240,240,240,240,240,240,255,48,96,192,128,192,96,255
01060 DATA 0,0,0,0,0,0,0,128,64,32,16,16,32,64,128
01070 CURS X,L:PCG:PRINT"ghi";:NORMAL:RETURN
01080 CURS X,L:PCG:PRINT"jkl";:NORMAL:RETURN
01090 CURS X,L:PCG:PRINT"mno";:NORMAL:RETURN
01100 CURS X,L:PCG:PRINT"pqr";:NORMAL:RETURN
01110 CURS 896:PRINT "     YOU HAVE WON $10     ":PLAY 19,8,10,24,10:W1=W1+10:GOTO
 510
01120 CURS 896:PRINT "     YOU HAVE WON $2      ":PLAY 24,20,24,20:W1=W1+2:GOTO 51
0
01130 CLS:CURS 524:PRINT"YOU HAVE LOST ALL OF YOUR MONEY !!!.":PRMT (?):PLAY 24,
23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7:CURS 651:INPUT"DO YOU WISH TO PL
AY AGAIN (yes/no)";K1$
01140 IF K1$="YES" OR K1$="yes" THEN GOTO 340
01150 IF W1<50 THEN CLS:CURS 530:PRINT "YOU HAVE LOST $";50-W1:CURS 590:PRINT "G
AMBLING IS NOT YOUR SCENE": POKE 220,111:END
01160 IF W1>50 THEN CLS:CURS 470:PRINT "YOU HAVE WON $";W1-50:CURS 527:PRINT "WE
LL DONE ! YOU KNOW WHEN TO STOP.":POKE 220,111:END
01170 IF W1=50 THEN CLS:CURS 530:PRINT "YOU ARE ALL EVEN,":CURS 582:PRINT "COME
ON WHERE'S THAT GAMBLING SPIRIT,PLAY AGAIN.":POKE 220,111:END
```



BOOK REVIEW

Wildcards *by Peter Ford, Ash Nallawalla and Bob Burt; published by BF & N Publishing, Williamstown Vic. 3016.*

Tom Moffat
39 Pillinger Drive, Fern Tree Tas. 7101

Have you noticed how the practice of computerism seems to be splitting into two groups, which we'll call Group A and Group B.

Group A people have probably spent around $3000 on their systems. They surround themselves with spinning disk drives and high-res monitors, and they understand things like Augmented Transition Networks and the meaning of Ada.

Their computers are highly developed, operating to a tightly structured set of rules. Any attempt to bend the rules usually results in an angry beep and an error message, and that's that.

Nevertheless, many Group As consider themselves to be the *real* programmers, and the rest of us are, well, the Group Bs.

Group Bs use the cheapie computers, the VIC 20s, the ZX-81s, the VZ200s, the Commodores and the Microbees.

The Group B's computer may even be home made. Group B may own a printer that doesn't work, but at least it was cheap. Group B may put rude comments in REM statements just for the shock effect on others who read his software.

Group B doesn't object to using GOTOs even though they're not in fashion at the moment, and they may even understand what a Z80 uses its IORQ line for.

Group B will try anything once, and their computers may be just tolerant enough to let them get away with it. Wildcards is aimed fair and square at Group B.

Although Wildcards was written specifically for the Microbee, users of other small computers will find it a good read. It's not a book of programs, although there are several complete programs in it. It's more a book of ideas, hints, data, and some jolly good experiments.

The very first bit of advice in Wildcards is to backup your programs onto cassette, and the authors even provide appropriate cassette labels with an invitation to photocopy them as required.

Because of the experimental nature of some of the programs some crashes are likely, and back-ups will save a lot of typing. It's a bit scary to spend an hour typing in a program, run it once, then delete most of it to find it still runs normally.

Wildcards then moves off to 'Tips and Techniques' — merging programs, mixing machine code and BASIC, and the book's first mention of embedding machine code in REM statements.

Next come some "Did you know thats" . . . like, did you know that (PRINT "TEST": PRINT: PRINT: PRINT: PRINT "TEST1": PRINT: PRINT) can also be written as (PRINT "TEST"////"TEST1"//)? That's only one of many sneaky tricks in Wildcards.

A major section of the book is devoted to the use of the Microbee's sound capabilities. There's a diagram of a piano keyboard and some standard musical notation, showing how the notes relate to the Microbee's PLAY command. Did you know that PLAY 0 can be used to generate a silent time delay up to 32 seconds long? Now why didn't I think of that?

There are several sound demo programs in the section, including another machine-code-into-REM job that lets you experiment with sounds other than PLAY . . . burbles and whistles and gliding tones.

The next few pages then take this sound program apart, modify it, explain it, and show you how to use its tricks in your own programs.

A section called 'Utilities' has such goodies as a program for investigating the contents of cassette headers, including those of non-Microbee origin. There's a program for printing your own 'fancy' cassette labels, and an interesting routine for making the Microbee think a BASIC program is a Wordbee file.

There's a whole section devoted to the efficient use of printers, but it's a pity there's no info on how to get a Microbee and a parallel printer to peacefully coexist, especially outside of BASIC. The authors state they all use serial printers so they probably haven't met up with the MicroBee's stubborn parallel routines.

'Graphics', gets into the Microbee's programmable character generator in a big way, with some good advice and good examples. One program mixes BASIC with REM-embedded machine code and REM-embedded data, finishing off with a block move of the whole screen to an area just above BASIC, where the whole works can be saved to tape.

The program takes one page and then an explanation of how it works, complete with disassemblies of the machine code routines, takes the next five. Good stuff.

But, I must now reveal, this program MLPAT1 contains a ripper of a bug. If you leave out spaces and some REMs, it will bomb out because it's too short!

It took a bit of work to figure out how this comes about, and I'm not going to reveal it here. It would be like giving away the plot of the book, and as I see it, that's what Wildcards is all about; figuring things out.

There are a couple of games presented, and at first sight you'll say "oh, no, not again!". They're Nim and Tic-Tac-Toe. But the authors have included them to show how all the good graphics stuff can be combined into a package. Once again, lots of notes on their workings.

We're not quite finished yet, there's still the appendix with graphics characters, hex/decimal/binary conversions, PCG address calculations, and an extensive memory map. There's even a library of DATA statements which make up graphics pictures.

Most of them seem to be for games programming . . . battleships, aircraft, bombs and sea monsters. I wrote a little program to try some of them.

One called 'ship with billowed sail' is particularly nice, and there's even a 'palm island' to run the ship into. The last picture is an outline of Australia, and speaking of islands, I'm happy to report that the authors did *not* leave Tasmania off, as was done at the Commonwealth Games and various other places.

All in all, I could only find one real complaint about Wildcards, in a section on setting audio levels into a cassette recorder's mic input. The authors show a voltage divider circuit of two to one. I've found something on the order of 50 to 1 is more appropriate. Many cassette reliability problems stem from recording at an extremely high level, resulting in distortion and bad data.

Is Wildcards good value? The asking price may at first seem a little steep at $15, but look at it this way; you wouldn't blink at spending that much on a program tape, and chances are you'll get more adventures out of Wildcards.

TYPING TUTOR MODIFICATIONS

Marcus Anderson, Doubeview WA

The original Typing Tutor program, written by J. Murfet of Tasmania, was published in the August issue of ETI.

I found the program interesting and useful enough to streamline a few areas and incorporate some 'essential' functions, such as lighting up the next key and passing over errors to maintain rhythm. I believe that the result is an optimisation of a well written program routine.

J. Murfet's program is one of the most functional programs I have come across in a magazine and was well worth the time I spent on it.

PRECISION FUNCTIONS

Miroslav Kosteckl, Elizabeth Park SA

The Microbee SD function allows adjustment of the precision of real numbers so that precision can be weighed against speed for your own programming application. Direct adjustment can be made by POKEing the desired precision into memory 2240, and precisions from 2 to 88 digits can be used.

But functions other than +, −, * and / are only calculated to 14 digits. So the Precision Functions program was written to provide some of the commonly used recursive functions to the above high precision. The ON ERROR is included to overcome the limit of the exponent only reaching 64 before under/overflow.

PRECISION FUNCTIONS

```
00120  POKE 2240,28 : REM  Digits
00130 PRINT "1. SQRoot"\"2. EXPonent"
00140 PRINT "3. COSine"\"4. SINe"
00150 INPUT "Function?";Z
00160 INPUT "Number?";A1
00170 A0=1: N1=0: F1=1: A2=0
00180 IF Z=1 THEN LET F1=0
00190 IF Z=4 THEN LET A0=A1:F1=A1:N1=1
00200 ON ERROR GOTO 260 : GOTO 250
00210 A0=(A0+A1/A0)/2: GOTO 240
00220 N1=N1+1: F1=F1/N1*A1: GOTO 240
00230 N1=N1+2:F1=-(F1/(N1-1)*A1)/N1*A1
00240 A0=A0+F1: IF A0=A2 THEN 260
00250 A2=A0: ON Z GOTO 210,220,230,230
00260 PRINT "Answer:";A0
00270 END
)REM EXAMPLE:

)POKE 2240,36

)PRINT 1/7+2.9
 3.042857142857142857142857142857142857

)RUN

1. SQRoot
2. EXPonent
3. COSine
4. SINe
Function? 3
Number? 3.14
Answer:-0.99999873172753954528511430 9
```

```
00150 REM When you run the program, the instructions are displayed and then the
00160 REM  PCG chr's are set up. The instructions are deliberately printed using
00170 REM  PCG chr's in order to retain the inherent 'graphic' effect.
00180 LORES:INVERSE: REM need this to restore PCG chr's
00190 CLS:POKE 257,1
00200 PRINT "   Typing tutor is a program  to test your typing accuracy.     "
00210 PRINT "   Sentences are printed at random and you are to copy them.    "
00220 PRINT "   The correct resting positions for your fingers are           "
00230 PRINT "   indicated by circles around the appropriate letters.         "+
00240 NORMAL:IF Z THEN 340
00250 STRS(500)
00260 DIM R1(8),Z1(8),S1(8),O1(8),C0(4),C(1,4)
00270 FOR I=1 TO 8:R1$(I)="":Z1$(I)="":S1$(I)="":O1$(I)="":NEXT I
00280 FOR I=0 TO 4:READ C0$(I):NEXT I
00290 FOR I=0 TO 4:READ C(0,I),C(1,I):NEXT I
00300 FOR I=1 TO 8:READ R1$(I):READ Z1$(I):READ S1$(I):READ O1$(I)
00310 NEXT I
00320 GOSUB 950
00330 Z=-1:CURS0:GOTO200
00340 K=63488+35*16
00350 FOR I=K TO K+16*5-1
00360 READ L:POKE I,L
00370 NEXT I
00380 INPUT "HOW MANY SENTENCES TO BE TESTED ? ";B
00390 IF B<1 THEN END
00400 INPUT "SENTENCES OR RANDOM LETTERS (S/L) )";A3$
00410 IF A3$<>"S" AND A3$<>"L"THEN 400
00420 CLS:CURS 1,10:PCG
00430 A0$=C0$(0):FOR I=1 TO 12:PRINT "#$"A0$(;I,I);"$X";:NEXT I
00440 CURS 3,11:A0$=C0$(1):FOR I=1 TO 11:PRINT "#$"A0$(;I,I);"$X";:NEXT I
00450 CURS 6,12:A0$=C0$(2):FOR I=1 TO 4:PRINT "#&"A0$(;I,I);"'X";:NEXT I
00460 FOR I=5 TO 6:PRINT "#$"A0$(;I,I);"$X";:NEXT I
00470 FOR I=7 TO 10:PRINT "#&"A0$(;I,I);"'X";:NEXT I
00480 CURS 8,13
00490 A0$=C0$(3):FOR I=1 TO 9:PRINT "#$"A0$(;I,I);"$X";:NEXT I
00500 CURS 15,14
00510 PRINT "#$$$$$$$$$$$$S$P$A$C$E$$$$$$$$$$$$X":NORMAL
00520 X=0
00530 FOR J=1 TO 8
00540 R=INT(RND*8)+1
00550 Z=INT(RND*8)+1
00560 S=INT(RND*8)+1
00570 O=INT(RND*8)+1
00580 IF A3$="S" THEN 620
00590 M1$="":FOR I=1 TO 30:A=INT(RND*30)+61:IF A<65 THEN LET A=32
00600 M1$=M1$+CHR(A):NEXT I
00610 GOTO 630
00620 M1$=R1$(R)+" "+Z1$(Z)+" THE "+S1$(S) +" "+O1$(O)
00630 CURS 25,1:PRINT" SENTENCE  "J
00640 L=(64-LEN(M1$))/2:CURS 1,8:PRINT ↑A60 32←
00650 CURS L+1,8:PRINT M1$;CHR(13);
00660 FOR I=1 TO LEN(M1$):A1$=M1$(;I,I):GOSUB 1030:CURS L+I,8:PRINT A1$CHR(8);
00670 A0$=KEY$:IF A0$="" THEN 670
00680 IF A0$=M1$(;I,I):PLAY1:GOTO700
00690 PRINT"*";:M=M+1:N=N+1:PLAY5
00700 NEXT I:PLAY 24
00710 IF M>2:CURS1,3:PRINT "YOU MADE"M" MISTAKES ON THIS LINE. TRY AGAIN."
00720 IF M>2:CURS 1,3:PLAY0,12:PRINT ↑A62 32←:M=0:GOTO640
00730 M=0
00740 NEXT J:CLS
00750 CURS 1,8:PRINT "OVERALL YOU MADE "N" MISTAKES."
00760 IF N>B*3 THEN PRINT "YOU NEED MORE PRACTICE. TRY SLOWING UP A BIT."
00770 IF FLT(N)<(FLT(B)*.3:IF FLT(N)=FLT(B)*.3 THEN PRINT "NOT BAD, KEEP IT UP."
00780 IF FLT(N)<(FLT(B)*.3 THEN PRINT "A VERY GOOD RESULT, CONGRATULATIONS."
00790 GOTO 380
00800 DATA "1234567890:-","QWERTYUIOP↑","ASDFGHJKL;","ZXCVBNM,.","/"," "
00810 DATA 1,10,3,11,6,12,8,13,25,14
00820 DATA "JOH BJELKE","THREW","FAT","PIG"
00830 DATA "THE QUICK BROWN FOX","JUMPED OVER","LAZY","DOG"
00840 DATA "LADY DI","KISSED","SMOULDERING","HAT BRIM"
00850 DATA "FRED","LICKED","SLIPPERY","FROG"
00860 DATA "HEATHER","SUCKED","COLD","RAT"
00870 DATA "BERT","SAT ON","SICK","DOG"
00880 DATA "DOREEN","PUSHED","SMUG","COW"
00890 DATA "BIGGLES","SHOT","SMOOTH","PRESSED HAM"
00900 DATA 0,127,64,64,64,64,64,64,64,64,64,64,64,64,64,127,0
00910 DATA 0,255,0,0,0,0,0,0,0,0,0,0,0,0,0,255,0
00920 DATA 0,254,2,2,2,2,2,2,2,2,2,2,2,2,254,0
00930 DATA 0,255,255,252,240,224,192,128,128,192,224,240,252,255,255,0
00940 DATA 0,255,255,63,15,7,3,1,1,3,7,15,63,255,255,0
00950 FOR I=63488 TO 63487+16*127 STEP 16
00960 FORJ=0TO15:POKEI+J, -1-PEEK(I+J):NEXT J
00970 POKE I+1,255:POKE I+14,255
00980 NEXT I
00990 FOR I=63488+16*65 TO 63487+16*91 STEP 16
01000 FOR J=2 TO 13:POKE I+J+512,-1-PEEK(I+J):NEXT J:POKE I+527,0
01010 NEXT I
01020 RETURN
01030 IF X>0 :CURS X,Y:PRINTCHR(A)
01040 FOR K=1 TO 3:P=SEARCH(C0$(K),A1$):IF P>0 THEN NEXT* K 1060 ELSE NEXT K
01050 A=32:CURS 39,14:PRINT CHR(255):X=39:Y=14:GOTO1070
01060 Y=C(1,K):X=C(0,K)+P*5-3:CURS X,Y:A=ASC(A1$):PRINTCHR(A+160)
01070 A=A+128:RETURN
```

MACHINE CODE MONITOR

Tony Clay, Logon Qld

This program allows you to enter in a machine language program and save and use it under BASIC control.

The program should be entered in hex which is then converted to decimal which can then be POKEd into memory.

To convert from hexadecimal to decimal the ASCII code is used of the depressed key; this gives 48-57 (0-9) or 65-70 (A-F), and then either 48 or 55 is subtracted to give a value of 0-16. The first hex character is multiplied by 16 and the second one added to give a value of between 0 and 255 (one hex byte).

The second half of this program allows the machine language program to be saved and used again. It creates DATA statements which can be merged with another program and executed with READ and POKE statements.

If you make a mistake while entering, finish the byte and then hit back-space and try again.


```
00100 DIM Z(5) :I=0 :CLS
00110 PRINT " PRESS [BACK SPACE] TO EDIT , [ESC] TO FINISH"
00115 REM CONVERT HEX ADDRESS TO DECIMAL
00120 PRINT\\"STARTING ADDRESS (IN HEX)"
00130 K=ASC(KEY): IF (K<48 OR K>57) AND (K<65 OR K>70)THEN 130
00140 PRINT CHR(K); :IF K<58 THEN LET K=K-48 ELSE LET K=K-55
00150 Z(I)=K: I=I+1 :IF I<4 THEN 130
00160 S = Z(0)*4096+Z(1)*256+Z(2)*16+Z(3): T=S :CLS
00170 UNDERLINE :PRINT"00  01  02  03  04  05  06  07";
00180 PRINT"  08  09  0A  0B  0C  0D  0E  0F" : NORMAL
00190 A=ASC(KEY)
00195 REM CHECK FOR ESCAPE OR BACKSPACE
00200 IF A=27 THEN 310
00210 IF A=8 THEN PRINT CA4 8]; :S=S-1 :GOTO 190
00215 REM ONLY LET 48-57 OR 65-70 ASCII CODES THROUGH
00220 IF (A<48 OR A>57) AND (A<65 OR A>70) THEN 190
00230 PRINT CHR(A);
00240 B=ASC(KEY)
00250 IF(B<48 OR B>57) AND (B<65 OR B>70) THEN 240
00260 PRINT CHR(B);"  ";
00265 REM CONVERT ASCII CODE TO DECIMAL NUMBER (0 TO 16)
00270 IF A<58 THEN LET A=A-48 ELSE LET A=A-55
00280 IF B<58 THEN LET B=B-48 ELSE LET B=B-55
00285 REM CREATE EQUIVALENT OF 1 BYTE hex (0 TO 255) AND POKE
00290 N= A*16+B: POKE S,N: S=S+1
00300 GOTO 190
00305 REM CREATE DATA STATEMENTS ON TAPE
00310 PRINT " Set up tape recorder , Press a key when ready"
00320 K0$=KEY : IF K0$="" THEN 320
00330 C=0: L=10000: OUT$2 ON: PRINT L;" DATA";
00340 FOR J=T TO S-1
00350 PRINT PEEK(J);",";  :C=C+1
00360 IF C<16 OR J=S-1 THEN 380
00370 L=L+10: PRINT CHR(13); CHR(10); L;" DATA"; :C=0
00380 NEXT J
00390 PRINT CHR(26) :OUT #2 OFF
00400 END
```

DATA 70 CHARACTER SET

D. J. Whyatt, Sth Plymptom, SA

To give your programs an authentic computer look, why not use Data 70 typeface?

The necessary data is given for 10 numerals and 26 upper case alphabetic characters. The UNDERLINE statement is used to set up the rest of the PCG RAM without the underscore to allow punctuation marks and spaces to be used.

This program can be merged on to an existing program with a GOSUB 1000 early in the host program to set up the PCG RAM, and set up PCG mode.

Data like this is a real pain to type in, but once done it can be recorded and used wherever you like. An example of the type is shown to encourage you to wade through it.

DATA 70 CHARACTER SET

```
01000 REM ******** DATA 70 TYPEFACE CHARACTER SET *********
01010 UNDERLINE:S=63488+ASC(" ")*16
01020 FOR L=S+15 TO S+94*16+15 STEP 16:POKE L,0:NEXT L
01030 RESTORE 1090:S=63488+ASC("0")*16
01040 FOR L=S TO S+10*16-1:READ D:POKE L,D:NEXT L
01050 RESTORE :200:S=63488+ASC("A")*16
01060 FOR L=S TO S+26*16-1:READ D:POKE L,D:NEXT L
01070 RETURN
01080 REM ******** DATA FOR NUMERAL SET *********
01090 DATA 0,0,0,0,127,65,65,65,65,65,65,127,0,0,0
01100 DATA 0,0,0,0,12,4,4,4,4,31,31,31,31,0,0,0
01110 DATA 0,0,0,0,31,1,1,1,31,16,16,16,31,0,0,0
01120 DATA 0,0,0,0,62,2,2,2,62,3,3,3,63,0,0,0
01130 DATA 0,0,0,0,96,96,96,96,96,99,127,3,3,0,0,0
01140 DATA 0,0,0,0,127,64,64,64,127,1,1,1,127,0,0,0
01150 DATA 0,0,0,0,120,72,64,64,64,127,65,65,127,0,0,0
01160 DATA 0,0,0,0,127,65,1,1,15,8,8,8,8,0,0,0
01170 DATA 0,0,0,0,62,34,34,34,127,99,99,99,127,0,0,0
01180 DATA 0,0,0,0,127,65,65,65,127,3,3,3,3,0,0,0
01190 REM ******** DATA FOR ALPHABET SET *********
01200 DATA 0,0,0,62,34,34,34,127,97,97,97,97,97,0,0,0
01210 DATA 0,0,0,126,66,66,66,127,97,97,97,97,127,0,0,0
01220 DATA 0,0,0,127,65,64,64,96,96,96,96,97,127,0,0,0
01230 DATA 0,0,0,127,65,65,65,97,97,97,97,97,127,0,0,0
01240 DATA 0,0,0,126,64,64,64,126,96,96,96,96,126,0,0,0
01250 DATA 0,0,0,126,64,64,64,126,96,96,96,96,96,0,0,0
01260 DATA 0,0,0,127,65,64,64,99,97,97,97,97,127,0,0,0
01270 DATA 0,0,0,65,65,65,65,127,97,97,97,97,97,0,0,0
01280 DATA 0,0,0,8,8,8,8,12,12,12,12,12,12,0,0,0
01290 DATA 0,0,0,2,2,2,2,3,3,3,3,67,127,0,0,0
01300 DATA 0,0,0,66,66,66,66,127,97,97,97,97,97,0,0,0
01310 DATA 0,0,0,64,64,64,64,96,96,96,96,96,126,0,0,0
01320 DATA 0,0,0,127,73,73,73,105,105,105,105,105,105,0,0,0
01330 DATA 0,0,0,127,65,65,65,97,97,97,97,97,97,0,0,0
01340 DATA 0,0,0,127,67,65,65,65,65,65,65,65,127,0,0,0
01350 DATA 0,0,0,126,66,66,66,126,96,96,96,96,96,0,0,0
01360 DATA 0,0,0,127,65,65,65,65,65,65,65,79,127,0,0,0
01370 DATA 0,0,0,126,66,66,66,127,97,97,97,97,97,0,0,0
01380 DATA 0,0,0,127,65,64,64,127,3,3,3,67,127,0,0,0
01390 DATA 0,0,0,127,8,8,8,12,12,12,12,12,12,0,0,0
01400 DATA 0,0,0,65,65,65,65,97,97,97,97,97,127,0,0,0
01410 DATA 0,0,0,97,97,97,97,99,34,34,34,62,0,0,0
01420 DATA 0,0,0,73,73,73,73,105,105,105,105,105,127,0,0,0
01430 DATA 0,0,0,33,33,33,33,127,97,97,97,97,97,0,0,0
01440 DATA 0,0,0,66,66,66,126,24,24,24,24,24,24,0,0,0
01450 DATA 0,0,0,127,65,1,1,127,96,96,96,97,127,0,0,0

THIS IS DATA 70. IT CAN ADD A TOUCH OF CLASS TO
OTHERWISE DULL PROGRAMS.
THE NUMERALS LOOK LIKE : 1 2 3 4 5 6 7 8 9 0
```

Computer club list

This list was compiled courtesy of Your Computer magazine Data Base.

A.C.T.

ACT Micro 80 Users Group, Bill Cushing, 10 Urambi Village, Kambah, 2902, 062 313630.

ACT Vic 20 Users Association, Chris Groenhout, 25 Kerferd St, Watson, 2602, 062 41 2316, Meetings 1st Monday each month at Boy's Grammar Scout Hall, Red Hill, 7.30 onwards.

ACTARI, Chris McEwan, Co-Ordinator, ACTARI, P.O. Box E112, Canberra, 2600, 062 88 7861.

Apple User Group (ACT), Jeff Brock, 1 Buckley Circuit, KAMBAH, 2902, 062 313630.

Australian ZX80 Users Group(AZUG), David Brudenall, 19 Godfrey Street, Campbell, 2601, for ZX80/Microace owners.

Canberra ACT Sirius User Group, Jim Bland, 062 81 2824, 062 81 2832.

Canberra Compucolor Club (CCC), Meets 7.30 on first Sunday of every month at the offices of Digital Equipment, 28 Lonsdale Street, Braddon ACT.

Canberra Microbee Users Group, Hugh Gibson, Microbee Store, Level 1, Cooleman Court, Weston, 2611, 062 88 6384.

Canberra Microbee Users Group, Adrian Van Wierst, 9 McGowan Street, Dickson, 062 49 7030.

Micsig, Registrar, P.O. Box 446, Canberra, 2601.

Omega, Geoff Cohen, 72 Spofforth Street, Holt, 2651.

Sorcerer Users of Australia, Mr G.T.Dick, 31 Cresswell st, Campbell, 2601.

N.S.W.

Albury-Wodonga Dist Mbee U.G., Eric Eulenstein, 202 Kooba St, Albury, 2640, 060 25 1601.

Apple Users Group, Colin Rutherford, P.O. Box 505, Bankstown, 2200, 02 520 0926.

Atari Computer Enthusiasts, Gary Francis, 78 Ayres Road, St. Ives, 2075, 2 0933 ext 354, or 789 1379.

Ausbug, Stephen Ford, P.O. Box 62, Londonderry, 2753.

Australasia ZX80 Users Group, Tony Mowbray, 87 Murphys Ave, Kieraville, 2500, 042 28 5296, for ZX80/81 Microace owners.

Australasian ZX80 Users Newsletter, 87 Murphys Ave, Kieraville, 2500.

Blue Mountains Microbee Computer Club, Roger Cooper, 047 58 7238.

Blue Mountains Computer Club, Eric Linsay or T. Macindoe, C/- P.O. Faulconbridge, 2776.

Central Coast Computer Club, Ron Thornton, P.O. Box 36, Ettalong Beach, 2257, 043 28 2862, 1st and 3rd Tuesday every month at Applied Technology, West Gosford, for all computers.

Commodore Users Group, John Guidice, G.P.O Box 4721, Sydney, 2001.

Compucolor Users Group, David Brown, 91 Regent Street, Chippendale, 2008.

Cumberland Computer User Group, S. O'Neil, 02 682 3851.

80-AT, The Australian 8080-Z80 Users, P.O.Box 165, Lakemba, 2195.

A.P.F. Users Group, Norm McMahon, 288 Kissing Point Road, TURRAMURRA, 2074, 02 44 2645.

Hawkesbury MicroBee Computer Club, Bruce Rennie, 045 67 7329.

Hunter U. G.- All Microcomputers, Secretary, P.O. Box 39, BROADMEADOW MNSW, 2298, Meets on the second Wednesday of each month in Room 308, building W, University of Newcastle at 7.45pm. Membership is primarily Apple II orientated, but anyone with interest in micros welcome.

Illawarra Microbee Computer Club, Ronald Read, 49 Beatus Street, Unanderra, 2526.

Illawarra Super 80 Users Group, Jim O'Grady, Chairman, P.O.Box 1775, Wollongong, 2500.

MEGS (Microcomputer Enthus. Group), John Whitlock, P.O. Box 3, St Leonards, 2065.

Macarthur Computer Association, R.G. Freind, 109 Campbellfield Ave., Cambelltown, 2560, 046 25 2752.

Mi Computer Club, Norma Jackson, P.O Box 21, Waterloo, 2017, 02 662 8888.

Newcastle Microcomputer Club, Mr. Gordon Johnson, Electron Microscope unit, University of Newcastle, 049 685045.

N.S.W. 6800 Users Group, 27 Georgina Ave., Keiraville, 2500.

Northern Beaches Vic User Group, E. Tuxford, 161 Barrenjoey Rd., Newport, 2106, Ph 997 2467, Community Centre.

Northern N.S.W MICC Chapter, Alen Hartley, Dundurrabin via Dorrigo, 2433, 066 57 8160.

Northside Microbee Computer Club, Tony Williams, 6 Tunks Street, WAVERTON, 2060, 267 7747 bh, Meets on third Saturday of each month from 1-5pm at McMahons Point Community Centre. This is at the junction of Lavender St and Blues Point Rd, just short walk from Nth Sydney station.

N.S.W Peach User Club, Daniel Soussi, 02 698 8286, weekly meetings on Saturday from 2pm at 'Cybernetics Research' 120-122 Lawson St Redfern.

Pocket Computer Users Club, George Antonijevic, 02 683 4296, for those interested in pocket computers, whatever the brand. Meetings held on the first Wednesday of each month at 7.30pm at the 'Woodstock' Community Centre, Church St. Burwood.

Sorcerer Users Group, Mr. Ian King, P.O. Box 62, St James, 2001.

Sutherland Super 80 Group, Jim Traeger, 02 525 2018, Super 80.

Sydney Forth Group, Peter Tregeagle, 10 Binda Road, Yowie Bay, 2228, 02 524 7490, Forth Computer Language.

Sydney MicroBee Users Club, Tony Wilson, 02 909 3957.

Sydney Peach User Group, Ben Sharif, 261 Northumberland Street, Liverpool, 2170, 02 601 8493.

T.I. Sydney Home Computer U.G., P.O. Box 149, Pennant Hills, 2120.

Victoria

Apple Users Society of Melbourne, G. Halprin, 03 859 5835.

AT Microcomputer Club, Grant Forest, 03 8792257ah, 03 699 2888 bh. This club has been formed for people interested in the Applied Technology DGOS Z80.

Atari User Groups Melbourne, Kelvin Eldridge, P.O. Box 173, 3073.

Australian Forth Interest Group, Tony Latermore, P.O. Box 704, SALE, 3850, 051 44 2011.

Australian North Star Users Assoc., P.O. Box 194, WANGARATTA, 3677.

Ballarat Computer Users Group, Publicity Officer: John Preston, 053 31 4363.

BUG 80 (Burwood Users Group), P.O. Box 46, BLACKBURN SOUTH, 3130.

Chip 8, 6800, 1802 User Group, Frank Rees, 27 King Street, BOORT, 3537.

Compucolor Users Group, L Ferguson, 12 Morphett Avenue, ASCOT, 3342.

Forth Interest Group, Lance Collins, P.O. Box 103, CAMBERWELL, 3124, 03 29 2600, Meets on the first Friday of the month.

Geelong Computer Club, Peter McKeon, P.O. Box 93, GEELONG, 3220.

IBM & Columbia Computer Users Club, Giles Bray, 22/11 Auburn Grove, Hawthorn East, 3123, 82 7632, 2nd Tuesday each month, 7.30 at the Victorian College of Pharmacy.

KAOS (Ohio Scientific), David Anear, 49 Millewa Crescent, DALLAS, 3047.

Kaypro Users Group, Stephen Foley, 03 857 7236.

Latrobe Valley Colour Computer U.G., George Francis, 31 Donald Street, Morwell, 3840, 22 1389, for TRS-80 & MC10 users.

Melbourne Atari Computer Enthusiast, Group is an Atari 400/800 personal computer user group for Australians and New Zealanders. Meetings held on first Sunday of each month at 12pm at 3M Australia Cnr. Blackburn & Ferntree Gully Rd., Melbourne.

Melbourne MicroBee Users Group, 03 741 5534.

Melbourne Super 80 Users Group, Hon. Sec. Victor Shuttleworth, 03 723 2713.

MICOM, Microcomputer Club of Melb., P.O. Box 60, CANTERBURY, 3126.

National Sinclair User Group, P.O. Box 148, GLEN WAVERLEY, 3150.

National ZX80 Users Club, 24 Peel Street, COLLINGWOOD, 3066.

Northn/Westn Sub. Comp. Users Group, John King (Secretary), 284 Union Road, MOONEE PONDS, 3039, 03 338 9304, Contact CP/M Data Systems.

Ohio Superboard Club, 27 McGown Road, MT ELIZA, 3930.

Peninsula Computer Club, George Thompson, 3 Patterson Street, Bonbeach, 3196, 772 2674, 2nd Tuesday each month at Chisholm College, Frankston, many types of computers are catered for. ▶

Computer club list

SMUG, SCORD M100 Users, Robin Miller, 60 Winmalee Drive, GLEN WAVERLEY, 3150.
Sorcerer Computer Users (Australia), Secretary, P.O. Box 144, DONCASTER, 3108.
The Motorola User Group Soc. (MUGS), Clive Allan, 11 Haros Avenue, NUNAWADING, 3131, 03 878 1298, Group is interested in 6800/02/09 based computers, particularly if running Flex although this is not a prerequisite to join.
Vic. Assoc. of Computer Educators, Arthur Totrall, P.O. Box 69, WHITTLESEA, 3757.
Victorian VZ200 User Group, Luigi Chiodo, 24 Don St., Reservoir, 3073, 03 460 3770.
ZX81 Software Exchange, C/- Chips Taens, 5 Muir Street, MT. WAVERLEY, 3149.

QLD

Apple-Q the Brisbane User Group, The Secretary, P.O. Box 721, SOUTH BRISBANE, 4101, Has User Group days every third Sunday of month at Hooper Education Centre, Kuran St. Wavell Heights. Centre is open from 8.30am till 4.30pm, members encouraged to bring Apple along.
Australian Sirius Users Group, P.O. Box 204, CHERMSIDE, 4032, 07 350 2611, Looks after the needs of Sirius One and Victor 9000 computer users. For membership form write to above address.
Brisbane Super 80 Users Group, Gary Gatfield, 08 355 3173. CBM/VIC Users Group Of N.T., Ian Diss, 089 27 9208.
Brisbane Youth Computer Group, A. Harrison, P.O. Box 396, Sunnybank, 4109.
Commodore Computer Users Group QLD, Mrs D D Dillan, P.O. Box 127, STONES CORNER, 4120.
Commodore Users Group, John Egan, P.O. Box 274, SPRINGWOOD, 4127, 07 287 2705, Is for owners of Pet/CBM and Vic-20 machines. Meetings held on the first Tuesday of the month at 130 Petrie Terrace, Brisbane.
Computer Owner's Group, Betty Adcock, 42 Lucan Ave, Aspley, 4034, 263 4268, 2nd Wednesday each month, 7.45 pm, all kinds of computer are catered for.
Gold Coast Microbee User Group, Col McLaren, 1-100 Imperial Parade, Labrador, 4215, 075 314610, meetings first Sunday each month, 3.00 at the Southport High School.
IREE Microcomputer Interest Group, N Wilson, P.O. Box 811, ALBION, 4010.
Mackay Microbee User Group, Geoff Gehring, Box 230, Mackay, 4740, 079 42 3214.
Superboard Users Group, Ed Richardson, 146 York Street, NUNDAH, 4012.
The Microcomputer Society, The Secretary, P.O. Box 580, FORTITUDE VALLEY, 4006, Meetings are held on the second Friday of each month in the Old Town Hall, corner Vulture and Graham Streets, Sth Brisbane. Meetings start at 7.30pm if main gate is closed use the back stairway.
Townsville MicroBee User Group TMUG, Chris Hayes, 077 796065ah, Meets at 7pm on the second Monday of the month. Another 'user' meeting is held later in the month. Meetings are held at Town and Country Computers, CTL Centre, Anne St. Aitkenvale QLD.
TRS80/System 80 Interest Group QLD, 396 2998, Meets on the first Sunday of each month at 21 Rodney St, Lindum, at 2 pm.
ZX 81 Club, P. Carswell, 22 Braud Street, BUNDABERG, 4670.

S.A.

Adelaide Atari Computer Club, Shirley Cornish, 11 Sweetwater Street, Secombe Gardens, 5047, 08 296 6553, 1st Monday each Month at 6 Mosely Street, Glenelg.
Adelaide Micro User Group, R. G. Stevenson, 36 Sturt Street, Adelaide, 5000, for TRS-80 and System 80 Users.
Beebnet, P.O. Box 262, KINGSWOOD, 5062, The group intends to produce a newsletter on a monthly basis. It is interested in any software producers or distributors who would be interested in serving the groups market requirements.
Commodore/Vic Computer Users Assoc., Mr Eddie Hann, 13 Miranda Road, PARALOWIE, 5108, The SA branch meets monthly.
Compucolor-Intecolor User of S.A., P.O. Box 86, Torrensville, 5031, 08 352 3296.
Darwin Microbee Users Group DBUG, Felino Molina, P.O. Box 3111, DARWIN, 5794, 089 82 5613bh, 089 88 1455ah.
Kaypro User Group, Myles Wakeham, 100 Pirie Street, Adelaide, 5000, 08 223 6333, meetings 1st Tuesday each month.
Microbee Users Club of S.A. MUCSA, Ross Savas, 26 Denman Terrace, Lower Mitchum, 08 277 7697.
N.T. 80 Computer User Group, R T O'Brien, 433 McMillans Road, Jingili, Darwin, 5792.
S.A. Commodore Computers U.G., Eddie Hann, The Secretary, P.O. Box 427, North Adelaide, 5006, 258 6367, meetings second Tuesday each month, 7.30 at Royal Caledonian Hall, 379 King William St, Adelaide.
S.A. Hitachi User Group, Cliff Hignett, 45a Ormond Ave, Daw Park, 5041, 08 274 9341.
S.A. Microprocessor Group Inc SAMG, The Secretary, P.O. Box 113, Plymton, 5038, 08 278 7288.
Sorcerer Users Group of S.A., Jeremy Webber, 22 Delange Avenue, BANKSIA PARK, 5019.
South Australian Apple Users Club, The Secretary, SAAUC, C/- The Bookshelf, 169 Pirie Street, Adelaide, 5000.
The Microcomputer Assoc. of the N.T, Andy Smith, Darwin Community College, CASUARINA, 5792.

W.A.

CU WEST WA Compucolor/Intecolor U.G., John Newman, 8 Hillcrest Drive, Darlington, 6070.
OSWEST-Osborne Users Group of W.A., 09 330 3439.
Perth 80 Users Group, C Powell, 09 457 6849, for System 80 and TRS 80 Users.
Perth Hitachi Peach Club, The Secretary, 1 Charf Court, Riverton, 6155, 09 367 5880, for Hitachi Peach & 6809s.
Sorcerer Computer Users of Aust., The Secretary, 90 King George Street, PERTH SOUTH, 6151, 09 367 6351.
Super 80 Users Group Perth, Garry Black, 19 Bendigo Way, CITY BEACH, 6015, 09 385 8813.
The W. A. Atari Computer Club, Mr Alf Gaebier (Secretary), P.O. Box 7169, Cloisters Square, PERTH, 6000.
W.A. Microbee Club, Mike Oborn, 09 447 5366.
Vic-Ups, G. Padfield, 09 451 4629.
W.A. ZX Users Group, Phil Taylor, 09 328 4111, (bh).
WA University Computer Club, 2nd Floor, University of WA, Guild Building, 09 386 1455.

Tasmania

Devonport Computer Interest Group, John Steveson, R.S.D 422, SHEFFIELD TASMANIA, 7306, 004 92 3237.
Spectravideo Computer Users Group, Mr W. P. Decket, 48 Heather Street, LAUNCESTON, 7250, 44 4836, Membership to the club costs $15 which entitles memebers to a newsleter and to discounts in computer equipment. Monthly meetings of the club are held.
TAS-Micro, Peter Deckert, Unit 1/456 West Tamar Road, RIVERSIDE, LAUNCESTON, 7250.
Tasmanian Commodore Users Assoc., Vincent T. Staggard, The Secretary, G.P.O. Box 391D, Hobart, 7000, 002 72 0295, Commodore and others
Tasmanian OSI User Group, David Tasker, 111 Bass Highway, Westbury, 7303.

N.Z.

1802 Users Group, P.O. Box 6210, AUCKLAND, NEW ZEALAND, For those who own an ETI-660 or a COSMAC VIP, you can contact the 1802 Users Group. Be kind and send them a return addressed envelope and some International Reply Coupon.
Nelson Vic Users Group, Peter Archer, Nelson VIC Users Group, C/o P.O. Box 860, Nelson N.Z., for Vic and Commodore.
Wellington Microcomputer Soc. Inc, Lindsay Williams, 2 Pope Street, PIMMERTON, NEW ZEALAND.
ZX81 Club, R Skelton, C/- Harbourside Orchard, WAIUKU NEW ZEALAND. ●

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Upgrading the ETI-668 Microbee EPROM programmer

Soup up that EPROM programmer. Speed up those verifies and option-up the software. Here's all the good oil from the collected wisdom of a number of project builders/modifiers.

Geoff Nicholls & readers

THE ETI-668 HAS BEEN one of the most popular Microbee projects and has stimulated a number of readers to offer suggestions to improve its performance. Most of the submissions received deal with speeding up the *Read*, *Verify* and *Test* routines so that they no longer take the same time as the *Program* routine. This modification requires making minor hardware and software changes.

Firstly though, a number of readers have told me that the software as published in February '83 does not assemble from the source code. I must confess that this is my fault, not Tom Moffat's.

At the time the project was prepared, we at ETI had a 64K Microbee without the Editor-Assembler. When Tom sent up the listing nobody at ETI knew anything about the assembler and it was left to yours truly to get the program going. When I came across the message routines in the source code they had been written as ASCII string definitions and only the first byte of each line had been assembled and listed, so I coded the rest by hand and we inserted the machine code in the listing.

(Later I discovered that the assembler had been set up to avoid wasting paper by printing the assembled code for such strings unless a special switch is used.)

The long and the short of all this is that the lines between 2060 and 2130 of the listing in Feb. '83 should be changed to the following if you are assembling from source code;

```
2070 MSG    DEFM 'ETI 668/ MICROBEE'
2080        DEFM 'EPROM PROGRAMMER$'
2090        DEFM 'START ADDRESS?$'
2100        DEFM 'FINISH ADDRESS?$'
2110        DEFM 'COMMAND?$'
2120 ERRM   DEFM '#%/&@ ERROR!$'
```

NOTE: Thanks to Ross Carter VK2SS for taking the trouble to write pointing this out.

Microbee clock speeds

One point to note about software timing routines (as used for the 55 millisecond delay around line no. 1330) is that they are obviously dependent upon the clock speed of the processor executing them. Most of the early Microbees ran at 2 MHz and the published software was for this speed. The Plus series also run at 2 MHz, but the colour/IC series run at 3.375 MHz. Applied Technology state that all systems from June 1983 have the 3.375 MHz clock. (The ETI Lab. Microbee seems to be something of a bastard since it runs at 3.000 MHz!)

If you use software timed to wait 55 ms on a 2 MHz machine, but your machine runs at 3.375 MHz, then the actual delay will only be about 33 ms, and incorrect operation will result. The solution is to increase the value loaded into the BC registers at line 1330 from 1000 to 2000. this is more than is strictly necessary so there is room to optimise the delay time.

Programming problems

A few readers have found that in attempting to program EPROMs, the Vpp voltage folds back to a few volts due to the 30 mA current limiting.

Daniel Ford wrote suggesting that the problem arises from the instruction sequence on page 49 of the original article, specifically the way the power was switched on before the EPROM was inserted. ▶

Checking the data books, he found that the Vpp supply should be established after (or simultaneously with) the Vcc rail. By plugging into a powered-up socket, there is a chance that the Vpp pin will contact first. We did not notice the problem before publication, and have not had any other readers report this problem, but nevertheless recomment that the programmer be switched off (and set to READ mode) while EPROMs are being inserted or removed.

Incidentally, several people in the electronics industry have warned us of a batch of 2716 EPROMs that have a programming failure rate of over 90%. If you are going to buy EPROMs in numbers it is wise to obtain a few first and see if they program correctly before shelling out too much money.

I have added a LED indicator to my programmer, connected from pin 8 on the personality socket to 0 V through a 4k7 resistor. The LED will glow brightly when Vpp is 21 or 25 V and dimly if Vpp is 5 V or less. The LED thus indicates the mode (READ or PROGRAM) and shows whether Vpp has dropped because of current limiting.

Some EPROMs may draw more than 30 mA from Vpp while programming, thus collapsing the supply. The original design figure of 30 mA was based on Intel devices, and you should have no problems with them, or those of matching specs.

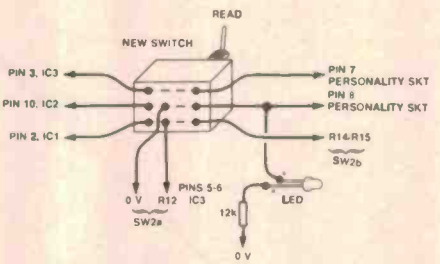
If you think your EPROMs may be exceeding the Intel spec, then try decreasing R14 from 18R to 8R2 which allows up to 70 mA to be drawn, with a slight increase in ripple.

Speeding up the reading routines

As promised, I'll explain how to remove the 55 ms delay in READing, TESTing, STEPing and VERIFYing your EPROMs.

Several different modifications were suggested by readers, the most impressive contribution came from C. J. Perkins, of Aspect Design in East Cannington W.A, who added several worthwhile feaures as well as speeding up the reading.

I decided to use the simplest hardware modification to avoid major surgery to the printed circuit board and R. Dolby's scheme got the nod. You will need to obtain a 4-pole, double-throw toggle switch to replace the READ/PROG switch.



Remove the link going to pin 10 of IC2 (under R17) and solder 150 mm of hookup wire to each pad. Solder another length of wire to the pad where pins 15 and 7 of the DB15 plug are connected (near R1). The wire from pin 10 of IC2 goes to the centre contact of one pole of the new switch. The wire from the other side of the link goes to the pole that is closed when the switch is in the read position. The remaining wire from the trigger pulse goes to the other contact.

Transfer the five wires from the old toggle switch to two of the poles on the new switch. That's all that needs to be changed in the hardware!

A revised software listing is provided here to utilise the new switching arrangement. I have added a few new features and changes selected from readers' contributions. The main change is to the input routines which now allows a return to EDASM if the ESC key is pressed or a restart if BREAK is pressed. If you have a source listing of the old version then you will find it easy to make the changes, since I have used the same line numbers as before and either inserted lines between the old lines or deleted them.

If you don't have the old source list on tape, then it would be easier to type in the machine code under the monitor rather than type the whole lot in. ●

SOURCE CODE

```
00100 ;ETI668 MicroBee eprom programmer
00110 ;       Tom Moffat, 19/12/82
00115 ;       Modified 1/11/83, G.Nicholls
00120
00130         DEFR    16
00140         ORG     0E00
00150
00160         LD      BC,0400 ;clear the screen
00170 START   LD      HL,0F000
00180 CLR     LD      (HL),020H
00190         INC     HL
00200         DEC     BC
00210         LD      A,B
00220         OR      C
00230         JR      NZ,CLR
00240
00250 ;Enter start and finish addresses.
00260
00270         LD      HL,MSG  ;point to messages
00280         LD      BC,0F08DH
00290         CALL    MESS    ;show title
00300         LD      BC,0F115
00310         CALL    MESS    ;show start address.
00320         CALL    ADDR
00330         PUSH    DE
00340         LD      BC,0F195
00350         CALL    MESS    ;show finish address
00360         CALL    ADDR
00370         LD      BC,0F215
00380         CALL    MESS    ;show command
00390
00400 ;Enter command, then jump.
00410
00420 COM     CALL    08006   ;get key
00430         CP      010H
00440         JR      Z,PROG
00450         CP      012H
00460         JR      Z,READ
00470         CP      013H
00480         JR      Z,STEP
00490         CP      014H
00500         JR      Z,TEST
00510         CP      016H
00520         JR      Z,VRFY
00530         CP      003H
00540         JR      NZ,COM
00545         CP      1BH
00546         JR      Z,EXIT
00550         LD      BC,021FH
00560         JR      START
00570
00580 ;PROGram from memory to EPROM
00590
00600 PROG    LD      HL,PROGM
00610         LD      A,0FH   ;set PIO for output
00620         CALL    INIT+2
00630         POP     HL
00640 PROG1   LD      A,(HL)  ;get byte from memory
00650         OUT     (0),A   ;send it to eprom
00655         CALL    DELAY
00660         CALL    SHODL   ;show addr then delay
00670         JR      PROG1
00680
00690 ;READ from EPROM to memory.
00700
00710 READ    LD      HL,READM
00720         CALL    INIT
00730         POP     HL
00740 READ1   IN      A,(0)   ;bring in a byte
00750         LD      (HL),A  ;store it in memory
00760         CALL    SHODL
00770         JR      READ1
00780
00790 ;STEP to new address.
00800
00810 STEP    LD      HL,STEPM
00820         CALL    INIT
00830         POP     HL
00840 STEP1   IN      A,(0)   ;fire trigger pulse
00850         CALL    SHODL
00860         JR      STEP1
00870
00880 ;TEST for complete EPROM erasure.
00890
00900 TEST    LD      HL,TESTM
00910         CALL    INIT
00920         POP     HL
00930 TEST1   IN      A,(0)   ;get byte from eprom
00940         CP      0FFH    ;is it erased?
00950         JR      NZ,ERROR
00960         CALL    SHODL
00970         JR      TEST1
00980
00990 ;VERIFY memory and EPROM are the same.
01000
01010 VRFY    LD      HL,VRFYM
01020         CALL    INIT
01030         POP     HL
```

```
01040 VRFY1   IN      A,(0)   ;get byte from eprom
01050         LD      C,(HL)  ;get byte from memory
01060         CP      C       ;are they the same?
01070         JR      NZ,ERROR
01080         CALL    SHODL
01090         JR      VRFY1
01100
01110 ;Show an ERROR message.
01120
01130 ERROR   LD      HL,ERRM
01140         LD      BC,0F299
01150         CALL    MESS
01160         LD      B,7
01170         CALL    800CH   ;BEEP!
01171         CALL    8006H   ;Get key.
01172         CP      1BH     ;ESC key?
01173         JR      Z,EXIT  ;yes,return to EDASM
01174         CP      03      ;BREAK key?
01175         JR      NZ,ERROR ;no,loop back.
01176         LD      BC,400H
01177         POP     HL      ;clear RET off stack
01178         JP      START   ;restart
01179
01180 ;Exit from program to EDASM.
01181
01182 EXIT    JP      0C000
01190
01200 ;Show HL and do time delay.
01210
01220 SHODL   LD      BC,0F224;screen location
01230         LD      A,0A0H
01240         LD      (BC),A  ;show a white space
01250         INC     BC
01260         INC     HL      ;to match eprom counter
01270         LD      A,H
01280         CALL    SHOW    ;show H register
01290         LD      A,L
01300         CALL    SHOW    ;show L register
01310         LD      A,0A0H
01320         LD      (BC),A  ;show a white space
01380         PUSH    HL
01385         SCF     ;reset carry flag by setting it
01386         CCF     ;then complementing it
01390         SBC     HL,DE
01400         POP     HL
01410         RET     C       ;finished?
01420         LD      BC,21FH ;for partial screen clear
01430         POP     HL      ;get RET off stack
01440         JP      START   ;finished
01450
01460 ;Show "A" register as a hex value.
01470
01480 SHOW    PUSH    AF
01490         RRCA
01500         RRCA
01510         RRCA
01520         RRCA
01530         CALL    $+4
01540         POP     AF
01550         AND     00FH
01560         ADD     A,0B0H
01570         CP      0BAH
01580         JR      C,$+4
01590         ADD     A,007H
01600         LD      (BC),A
01610         INC     BC
01620         RET
01630
01640 ;Enter an address,show it and put it in DE.
01650
01660 ADDR    CALL    $+4
01670         LD      D,E
01680         CALL    KEY
01690         RLCA
01700         RLCA
01710         RLCA
01720         RLCA
01730         LD      E,A
01740         CALL    KEY
01750         OR      E
01760         LD      E,A
01770         RET
01780
01781 ;Clear RET's off stack, restart program.
01782
01783 RST     POP     HL
01784         POP     HL
01785         LD      BC,400H
01786         JP      START
01787 ;
01790 ;Get a key,convert to hex and show it.
01800
01810 KEY     INC     BC
01820 KEY1    CALL    8006    ;key input into A
01825         CP      1BH
01826         JR      Z,EXIT
01827         CP      03
01828         JR      Z,RST
01830         LD      (BC),A
01840         SUB     30      ;convert ASCII to hex
01850         JR      C,KEY1  ;if less than zero
01860         CP      00AH
01870         RET     M       ;if between 00-99
01880         SUB     007H
01890         CP      00AH
01900         JR      C,KEY1  ;if less than 0AH
01910         CP      010H
01920         JR      NC,KEY1 ;if more than 0FH
01930         RET
01940
01941 ;Delay 55mS subroutine
01942
01943 DELAY   LD      BC,02000H ;adjust BC to optimise
01944         DEC     BC        ;pulse length(see text)
01945         LD      A,B
01946         OR      C
01947         JR      NZ,$-3
01948         RET
01949
01950 ;Initialize PIO and/or show a message.
01960
01970 INIT    LD      A,4FH   ;set PIO for input
01980         OUT     (001H),A
01985         DI      ;disable interrupts
01990 MESS    LD      A,(HL)
02000         INC     HL
02010         CP      '$'     ;"$"=MSG terminator
02020         RET     Z
02030         LD      (BC),A
02040         INC     BC
02050         JR      MESS
02060
02070 MSG     DEFM    'ETI 668/MicroBee
02080         DEFM    'Eprom Programmer$
02090         DEFM    'START ADDRESS?$'
02100         DEFM    'FINISH ADDRESS?$'
02110         DEFM    'COMMAND?  $'
02120 ERRM    DEFM    '$$\$@ ERROR!$'
02130
02140 ;Command labels, reverse video.
02150
02160 PROGM   DEFW    0D0A0   ;PROG$
02170         DEFW    0CFD2
02180         DEFW    24C7
02190 READM   DEFW    0D2A0   ;READ$
02200         DEFW    0C1C5
02210         DEFW    24C4
02220 STEPM   DEFW    0D3A0   ;STEP$
02230         DEFW    0C5D4
02240         DEFW    24D0
02250 TESTM   DEFW    0D4A0   ;TEST$
02260         DEFW    0D3C5
02270         DEFW    24D4
02280 VRFYM   DEFW    0D6A0   ;VRFY$
02290         DEFW    0C6D2
02300         DEFW    24D9
02310
02320         END
```

HEX DUMP

```
Addr   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

0E00:  01 00 04 21  00 F0 36 20  23 0B 78 B1  20 F8 21 53
0E10:  0F 01 8D F0  CD 4A 0F 01  15 F1 CD 4A  0F CD 03 0F
0E20:  D5 01 95 F1  CD 4A 0F CD  03 0F 01 15  F2 CD 4A 0F
0E30:  CD 06 80 FE  10 28 1D FE  12 28 2D FE  13 28 38 FE
0E40:  14 28 42 FE  16 28 50 FE  03 20 E5 FE  1B 28 7A 01
0E50:  1F 02 18 AF  21 AC 0F 3E  0F CD 47 0F  E1 7E D3 00
0E60:  CD 3C 0F CD  CC 0E 18 F5  21 B2 0F CD  45 0F E1 DB
0E70:  00 77 CD CC  0E 18 F8 21  B8 0F CD 45  0F E1 DB 00
0E80:  CD CC 0E 18  F9 21 BE 0F  CD 45 0F E1  DB 00 FE FF
0E90:  20 17 CD CC  0E 18 F5 21  C4 0F CD 45  0F E1 DB 00
0EA0:  4E B9 20 05  CD CC 0E 18  F5 21 9F 0F  01 99 F2 CD
0EB0:  4A 0F 06 07  CD 0C 80 CD  06 80 FE 1B  28 0B FE 03
0EC0:  20 E7 01 00  04 E1 C3 03  0E C3 00 C0  01 24 F2 3E
0ED0:  A0 02 03 23  7C CD ED 0E  7D CD ED 0E  3E A0 02 E5
0EE0:  37 3F ED 52  E1 D8 01 1F  02 E1 C3 03  0E F5 0F 0F
0EF0:  0F 0F CD F6  0E F1 E6 0F  C6 B0 FE BA  38 02 C6 07

Addr   0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F

0F00:  02 03 C9 CD  07 0F 53 CD  1D 0F 07 07  07 07 5F CD
0F10:  1D 0F B3 5F  C9 E1 E1 01  00 04 C3 03  0E 03 CD 06
0F20:  80 FE 1B 28  A4 FE 03 28  EC 02 D6 30  38 F0 FE 0A
0F30:  F8 D6 07 FE  0A 38 E7 FE  10 30 E3 C9  01 00 20 0B
0F40:  78 B1 20 FB  C9 3E 4F D3  01 F3 7E 23  FE 24 C8 02
0F50:  03 18 F7 45  54 49 20 36  36 38 2F 4D  69 63 72 6F
0F60:  42 65 65 20  45 70 72 6F  6D 20 50 72  6F 67 72 61
0F70:  6D 6D 65 72  24 53 54 41  52 54 20 41  44 44 52 45
0F80:  53 53 3F 24  46 49 4E 49  53 48 20 41  44 44 52 45
0F90:  53 53 3F 24  43 4F 4D 4D  41 4E 44 3F  20 20 24 23
0FA0:  25 5C 26 40  20 45 52 52  4F 52 21 24  A0 D0 D2 CF
0FB0:  C7 24 A0 D2  C5 C1 C4 24  A0 D3 D4 C5  D0 24 A0 D4
0FC0:  C5 D3 D4 24  A0 D6 D2 C6  D9 24
#
```

THE VIC-20 COLUMN

★ENCOURAGEMENT★

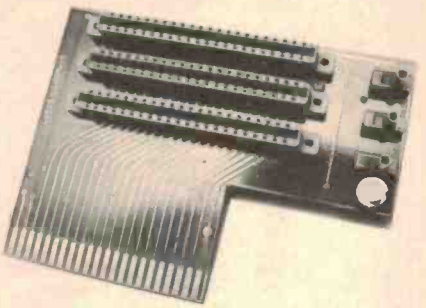
Ozi-Soft, in conjunction with Computer Technics, is offering to donate a VIC-20 expansion board for the best software item submitted to this column every month.

The board is Australian-designed and manufactured and simply plugs into the VIC-20's expansion slot. It features three sockets that can be independently switch-selected, plus an on-board reset switch. With it you can plug in up to three separate expansion units to your VIC-20 and avoid the hassle of plugging things in and out and turning the computer on and off each time.

It is distributed by **Computer Technics, 123 Clarence Street, Sydney (G.P.O. Box 4936) NSW 2000. (02)29-7244.** The board costs $59.95.

All submissions must be accompanied by a signed letter from you stating that it's your original work. The winning submission will be judged by the Editor and no correspondence will be entered into. All published submissions will be paid for.

Send entries to: The Editor, VIC-20 Column, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.



Peter Terren of Yokine WA is the January winner of the VIC-20 expansion board. The program he wrote to control radio-controlled model servos is multi-functional. It could also be used to control robot arms, mechanical latches/locks, plotting devices etc. As you can see, the results are good and the number of applications are limited only by your imagination.

CONTROL MODEL SERVOS

Peter Terren, Yokine WA

This program allows the VIC to easily control radio-controlled model servos; these are readily available matchbox-sized devices with a mechanical output shaft rotating through approximately 180° in response to a positive electrical pulse of 1-2 ms duration, with pulse lengths proportional to the angle of rotation.

These servos run off four NiCads of typically 5 V, with a current drain of 20-50 mA with no load and up to 150 mA to 1 A stall current. For many simple applications this is quite within the capacity of the VIC's power supply and does not seem to cause interference to either the power supply or the servos.

These servos are available for $30 upwards new but many radio-control modellers with model cars, planes, boats etc, will have a few lying around.

Applications could include anything requiring electrical to mechanical conversion in a controllable fashion e.g: robot arms, 'turtles', running radio-controlled models directly via computer, mechanical latches/locks or plotting devices.

I have used three servos to control a simple plotter with a resolution of 170 x 170 using the servos to control the X co-ordinate, Y co-ordinate and pen lift. See the accompanying results.

The program allows independent control of six servos, however, I suggest that you run no more than three servos off the VIC; any more would require an external power supply.

Output to the servos is directly via the user port, pins PB0-PB5. The program sets up a machine code routine to output pulses on the user port. Each pulse width is determined by the contents of locations 7664-7669 respectively for servos 1-6.

To operate the program one pokes values between 1-170 into each location required and executes the machine code routine SYS7408. This SYS may need to be repeated up to 200 times maximum (approx. one second) for mechanical equilibrium e.g: to get servo one to midposition and servo two to full clockwise (0°).

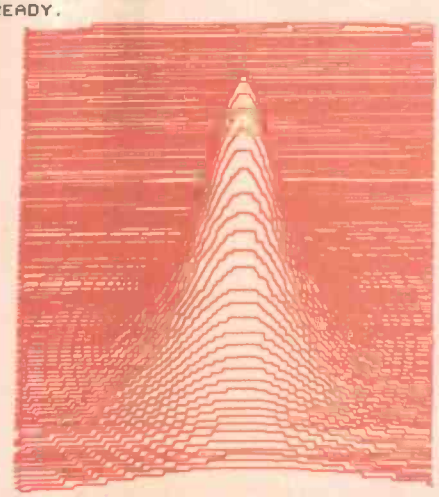
```
100 POKE 7664, 85: POKE 7665, 1
101 FOR T = 1 TO 100: SYS7408: NEXT
```

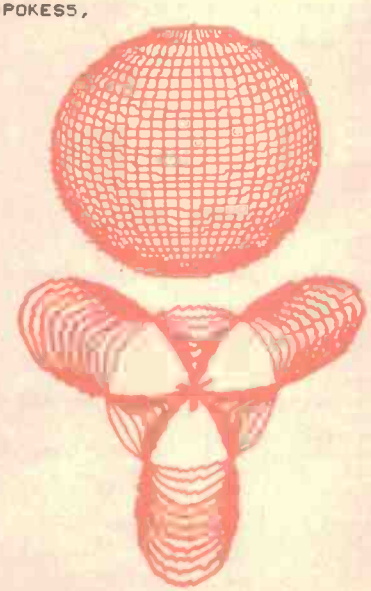
Using the simple example shown in the listing one can input any value and see the result. Note:

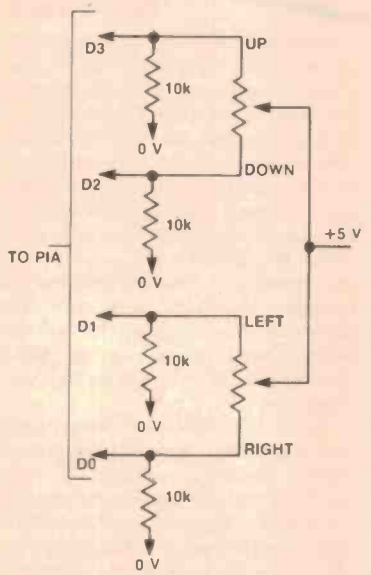
1. This program runs on the unexpanded VIC only.
2. When connecting the servos, there are three wires; +5 V, pulse, 0 V. The polarity of the wires can be determined from the manual, measured in use with a radio-controlled setup or tested for continuity of +5 V, 0 V with battery leads. Or the same colour code as the battery leads can be used.
3. There is approximately 1.5K of program space left for BASIC to develop this program in an application.

CONTROL MODEL SERVOS

```
1 PRINT"□ SERVO CONTROLLER      [C]   P TERREN 1983      FOR UNEXP. VIC"
2 PRINT"SERVO 1 IS CONNECTED  TO PB0 AND IS RUN BY "
3 PRINT"POKING MEM LOCATION   7665 WITH A NUMBER     BETWEEN 1 - 170"
4 PRINT"THEN: SYS7408.THIS MAY NEED TO BE REPEATED  UP TO 200 TIMES IN A"
5 PRINT"LOOP BEFORE MECHANICALEQUILIBRIUM OCCURS"
6 PRINT:PRINT"SIMILARLY FOR SERVOS  2 TO 6 WITH PB1 TO 5"
8 PRINT"AND LOCATIONS 7666TO  7670"
12 REM PROTECT MEMORY
13 POKE51,239:POKE52,28:POKE55,239:POKE56,28
17 S1=7665:S2=7666:S3=7667:S4=7668:S5=7669:S6=7670:POKE7671,80
18 REM MACHINE CODE *
19 FORX=0TO240:READA:POKE7408+X,A:NEXT
20 DATA169,63,141,18,145,169,0,120,168,169,63,45,16,145,141,248
22 DATA29,169,1,13,248,29,141,16,145,162,0,232,236,247,29,208,250,200
24 DATA204,241,29,208,250,169,0,13,248,29,141,16,145,169,0,168,76
26 DATA39,29,234,234,169,2,13,248,29,141,16,145,162,0,232,236,247,29
28 DATA208,250,200,204,242,29,208,250,169,0,13,248,29,141,16,145,169
30 DATA0,168,76,77,29,234,234,169,4,13,248,29,141,16,145,162,0
32 DATA232,236,247,29,208,250,200,204,243,29,208,250,169,0,13,248,29
34 DATA141,16,145,169
36 DATA0,168,76,115,29,234,234,169,8,13,248,29,141,16,145,162,0
38 DATA232,236,247,29,208,250,200,204,244,29,208,250,169,0,13,248,29
40 DATA141,16,145,169
42 DATA0,168,76,153,29,234,234,169,16,13,248,29,141,16,145,162,0
44 DATA232,236,247,29,208,250,200,204,245,29,208,250,169,0,13,248,29
46 DATA141,16,145,169,0,168,76,191,29,234
48 DATA234,169,32,13,248,29,141,16,145,162,0
49 DATA232,236,247,29,208,250,200,204,246,29,208,250,169,0,13,248,29
50 DATA141,16,145,88,96,0,255,255
100 REM***************
101 REM EXAMPLE *****
105 PRINT:PRINT" ENTER SERVO POSITION  (1TO170)(ALL SERVOS)"
107  INPUTB:IFB<1ORB>170THEN107
108 REM REPEAT SYS      UNTIL KEY PRESSED **
120 POKES1,B:POKES2,8:POKES3,B:POKES4,8:POKES5,
    B:POKES6,B
125 SYS7408:GETA$:IFA$=""THEN125
130 GOTO107
READY.
```







JOYSTICK MODIFICATION

Tony Southern, Titahi Bay NZ

If you find multi-fingered games difficult to play, you can modify the '660 so that you can use a joystick to get the feel of a real arcade game.

If you connect the user PIA to the unused socket adjacent to the 6821, you can connect the joystick to the '660 via a ribbon cable and plug. All eight data lines, CB1, CB2, the stable input Z, the outputs 1, 7 and 4 and both rails can terminate neatly on the socket.

The routine to initialise the PIA is machine code at 0F00 and the Chip 8 routine and machine code to read it is at 0F18. To modify most Chip 8 programs to use the joystick try the following suggestions. Note that register 0 is modified by these routines.

1. Place a 1F20 instruction at address 0600 and replace the original instruction at address 0F22.
2. Locate the key pressed routine in the program you wish to modify and at the first location place a 1F26 instruction. Make the remaining instructions test register 0 for 01 — left, 02 — right, 04 — down and 08 — up. Fill any spaces with 00FFs.
3. At address 0F34 put the value of the I pointer before the key test routine (the PIA routine changes it) and at 0F36 put the address of the first direction test instruction you inserted into the program.

You will have just created two patches to initialise and then to read the PIA.

0F00 93BF F883 AFEF F800 5F62 2F2F 5F62 F820
0F10 5F62 D400 0000 0000 93BF F886 AFEF 6AD4
0F20 0F00 ZZZZ 1602 0F18 AF86 F065 8006 8006
0F30 8006 8006 AYYY 1XXX

Note that 0F80-0F87 are used as access addresses by this routine.

SPACE INVADERS MKIV. These are the required changes to the Space Invaders MKIII program which was published in ETI, November 1982.

0600 1F20
0624 1F26 4001 74FF 4002 7401 4004
0630 6600 00FF 00FF
0F22 A68C
0F34 A688 1626

Move the joystick down to fire the missile.

BLOCK EXTERMINATION

W. F. Kreykes, St Albans Vic.

To gain the highest score you must exterminate all blocks before the fuel is depleted. You can only fire at the blocks when the colour of your ship is the same as the colour of the block above or below.

The score starts at 50 000 and is added to when the blocks explode. When a block is hit which is not the same colour as the ship, the score is deducted according to the scale: black 0; red 100; blue 200; violet 300; green 400; yellow 500; light blue 600; white 700.

For a bonus you get up to six boxes in the top clone worth ten times their current value. But a pitfall is that you can lose up to six boxes in the bottom clone with ten times their current value deducted from your score.

If you fire and fail to exterminate a box, fuel is wasted and the box changes colour to red or black. The more a ship is moved the more fuel is used; when a block is exterminated some fuel is saved.

A new game starts if all the blocks are exterminated before the fuel is depleted. Another set of blocks will appear, your score is doubled, the background colour changes to red and the blocks are worth double what they were in the first round. However, you will have less time than in the first round.

Game A (black background) ends when the fuel is depleted. Press any key to restart. When game B (red background) ends you will hear a continuous sound; press RESET "8" to start game A again.

The controls are: 1 fire up; 9 fire down; B move left; D move right.

The following variables are used:

V0-V5	Various, add and deduct, score display.
V6	Fuel line, amount presently left.
V7	Timing of fuel consumed.
V8	Various, value of box to add to score.
V9	Number of boxes exterminated.
VA	Memory advance box dealing with.
VB	Explosion display co-ordinate.
VC-VD	Ship display co-ordinate.
VE	Detects up/down, top/bottom.
VF	Detection, timing, sound effects.

0600-069A sets up the start of the game to play game 'A'. Note that the section from 0604 to 062A physically changes instructions that are underlined in the program.

069C-06AA develops and saves bonus and dud boxes, then saves them in a stack starting at 0C88; V0-V2 = bonus, V3-V5 = duds. No provision has been made to prevent the same number being developed more than once, thus you may not always have six boxes of each.

06BC-06FE runs the main program; this calls subroutines as required. The 4300 @ 06CC detects move left or right, this stops the ship flashing in a stationary position.

When a fire button is pressed VE = 1 for up and 9 for down; this is used by other segments of the program to detect up/down top/bottom clone. The 8875 @ 06F6 checks to see if V7 is over 80/A0 and if so VF will be equal to 0 and thus the 27D6 will reduce the fuel line and change the colour of the ship.

070C-072A prints the scores. The 4420 @ 0720 makes the 1000s space in the score. This is included so that the same routine can be used to print the bonus and dud amount but not the space as V4 will only be equal to 20 when printing the score (when V4 starts @ 14).

073A-0780 adds and deducts the score stored in decimal @ 0CD8 which is set to 0500 at the start of each game. The last two zeros are placed there at the start of the game and do not change. This gives the effect of x 100. This special routine had to be made because Chip-8 cannot add over 255 and will now show a true negative score. The routine has been designed to have an upper limit of 9999 but can add over this limit.

0782-0796 notice how it is possible to add a variable to itself, i.e: 8884!

07D6-0870E this routine performs three functions; it reduces the fuel line, then changes the ship's colour, then checks to see if all the fuel is depleted. As at this stage V0 is not in use, the AD20 F165 takes the present ship's colour out of memory and it is V1. This saves memory as the alternative would be AD21 F065 8100. V0 is then developoe and compared with V1; if they are the same V0 is re-developed by the 9010.

By the way, check out this routine when V6 is equal to 40. This is the restart, but what I mean is the fact that in this case the subroutine originally called at 06FA returns to itself, thus cancelling out the requirement of ending in 00EE!

0810-0850 is the heart of the program and is several subroutines in one (if you follow through the program). When called @ 06FC develops VA to a random value between 0 and 67 @ 0818. It then checks with the video refresh memory to see if this box is still alive and if so develops a new colour with V0, converts VA to V1 and V2 and then changes the box to the new colour. The A488 3E01 A540 is required as VA memory advance cannot hold a value over FF.

0852-0876 fires the shells and detects a hit or a miss. The value of VE determines whether to fire up or down.

0878-08D8 is several subroutines in one. Its job is to convert after a hit VC & VD to VB & VA and compare the colour of the box with the ship. If they are not the same colour it deducts the points from the score, changes the colour of the box to red or black, adds to the fuel loss (7708), then replaces the shells and returns to the main program. The 9800 @ 08BA detects a match.

08DA-093E does all the fancy work when you've got a match. The explosion is displayed in seven segments; in between these it produces the sound effects, changes the box colour, checks for bonus or dud, adds the value of V8 to the score and changes the box colour to yellow in the end to give a moving effect.

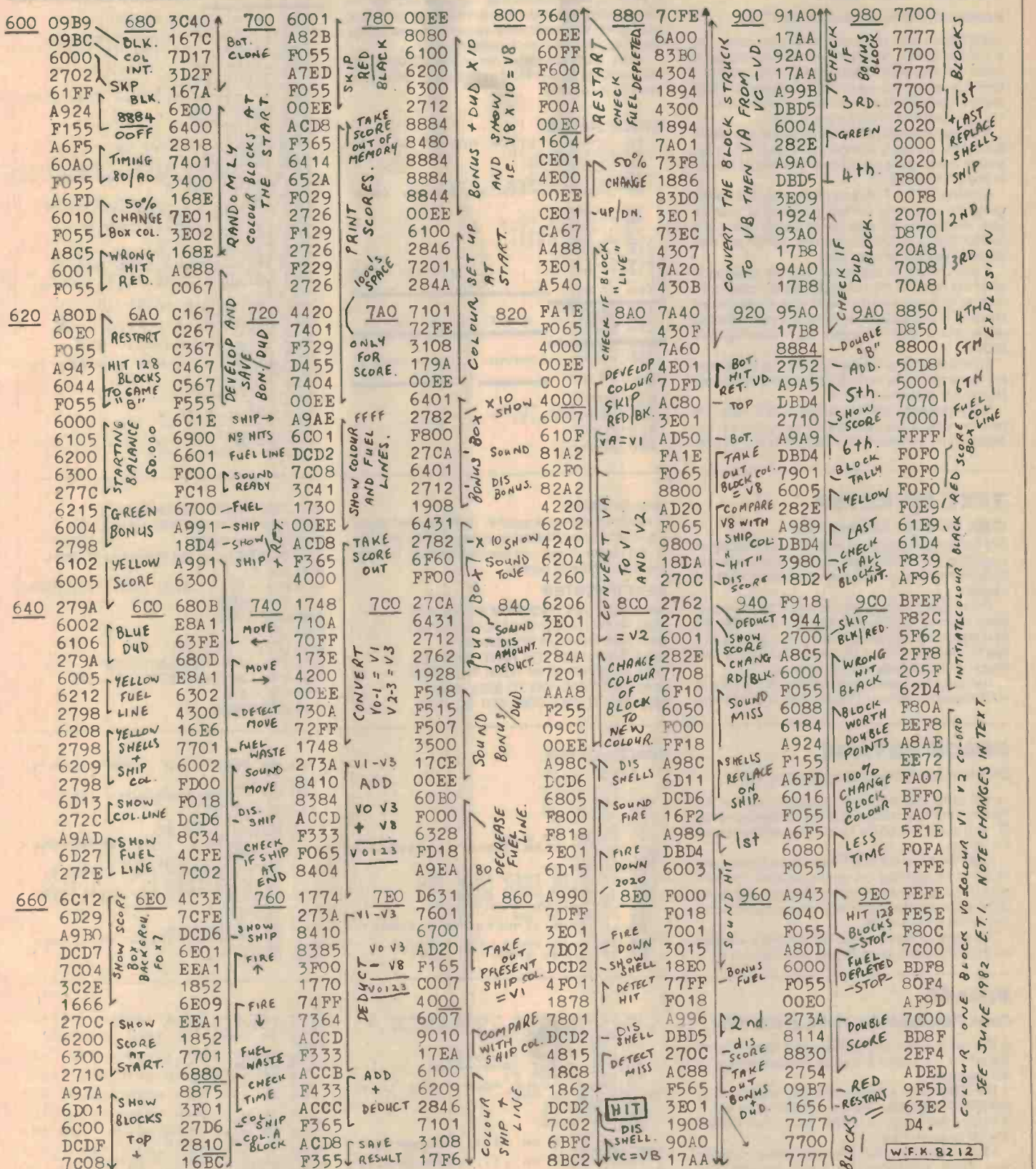
Note that the 8884 @ 0924 is set to 00FF for game 'A' at 060C. It also checks the number of boxes struck.

0940-0978 changes the instructions to work game 'B', doubles the score, changes the background colour to red then restarts the game. The value of V0 @ 095C sets the amount of fuel for each colour change; this value can be altered.

09CC-09FA is a machine code subroutine that colours a block as shown in the April 1982 issue. I have changed the address at 09CD and 09D0 to 0AA8; this is where V0, V1 and V2 are stored for colouring a block.

It must be understood that for this program to check and compare colours the stack address @ 09E5 (0C) & 09EA (80) making 0C80 must not be altered. The position of each colour block on the screen is directly related to a location in this stack.

BLOCK EXTERMINATION



ZX COLUMN

STOCK MARKET

Benjamin Smith, Mount Nelson Tas.

Stock Market is an investment simulation game. You are asked to enter the names of four companies in which you may wish to hold shares. A 'status-report' then appears giving your capital (initially $10 000) and the current nett value of your shares in each of the four companies (this begins at $0).

A prompt is displayed at the bottom of the screen asking you to specify whether you wish to buy or sell shares in any of the companies. You should type 'B' to buy or 'S' to sell.

Entering 'E' (for Exit) ends the game, the display giving the total value (including capital) of your assets; the higher this sum is, the better, and if it is greater than $10 000 (the starting capital) you may consider yourself to have won.

If you choose to buy stock, you are required to enter the name of the company and the amount (in dollars) that you wish to invest. The computer will continue to prompt until you specify a valid company name and a sum of money not exceeding your capital.

Selling stock is achieved in much the same way, but the amount you enter is added back on to your capital, not subtracted from it.

Fairly frequently you will receive a 10% return on your investment in a particular company; the value is displayed on the screen and credited to your capital.

In addition, share values may rise or fall (sometimes dramatically) and it is often advisable to sell stock back when it is particularly valuable. A new status report appears after each transaction.

Finally, Stock Market will run on both a ZX81 and a ZX80 with the drop-in ROM modification. 16K of user memory is required.

STOCK MARKET

```
  10 REM *** STOCK MARKET ***
  20 DIM C$(4,10)
  30 DIM T$(10)
  40 DIM C(4)
  50 LET C=10000
  60 PRINT "ENTER 4 COMPANY NAME
S ..."
  70 PRINT
  80 FOR I=1 TO 4
  90 INPUT C$(I)
 100 PRINT C$(I),
 110 NEXT I
 120 CLS
 130 PRINT "       --- STATUS REPO
RT ---"
 140 PRINT "-------------------
-------"
 150 PRINT
 160 PRINT "   CAPITAL   $ ";C
 170 PRINT "-------------------
-------"
 180 PRINT
 190 PRINT "COMPANY","INVESTMENT
"
 200 PRINT "-------","----------
"
 210 PRINT
 220 FOR I=1 TO 4
 230 PRINT C$(I),"  $ ";C(I)
 240 PRINT
 250 NEXT I
 260 PRINT
 270 PRINT "-------------------
-------"
 280 PRINT "BUY/SELL? ";
 290 INPUT U$
 300 IF U$="E" THEN GOTO 630
 310 IF U$<>"S" AND U$<>"B" THEN
 GOTO 290
 320 PRINT U$;"  COMPANY ";
 330 INPUT T$
 340 FOR I=1 TO 4
 350 IF T$=C$(I) THEN GOTO 380
 360 NEXT I
 370 GOTO 330
 380 PRINT T$
 390 PRINT
 400 PRINT "AMOUNT  $ ";
 410 INPUT A
 420 IF A<0 OR A>C(I) AND U$="S"
 OR A>C AND U$="B" THEN GOTO 410
 430 PRINT INT A
 440 CLS
 450 IF U$="S" THEN LET A=-A
 460 LET C=C-INT A
 470 LET C(I)=C(I)+INT A
 480 PRINT AT 5,0
 490 FOR I=1 TO 4
 500 LET A=INT (RND*40-19)
 510 IF A=0 THEN GOTO 500
 520 LET C(I)=INT (C(I)*C(I)/A)
 530 IF RND>.3 OR C(I)<10 THEN G
OTO 570
 540 LET A=INT (C(I)/10)
 550 LET C=C+A
 560 PRINT C$(I),"RETURN  $ ";A
 570 NEXT I
 580 IF C=0 THEN GOTO 630
 590 PRINT
 600 PRINT "  ( HIT ANY KEY TO C
ONTINUE )"
 610 PAUSE 110
 620 GOTO 120
 630 CLS
 640 FOR I=1 TO 4
 650 LET C=C+C(I)
 660 NEXT I
 670 PRINT AT 8,0;"*** YOU FINIS
H WITH $ ";C;" ***"
```

TEXT INVERTER

Colin Burchall, Ashwood Vic.

The following program was written for my ZX80 when I decided that REMark statements were not easily findable in a program. It simply converts the text to its inverse.

The program loads in the first character of the program and if its a REM, then it proceeds to invert the next characters by adding 128 to their code, until it reaches the N/L code, 118. It then loads in the next character until it finds another REM etc.

The program ceases execution when it gets to VARS which is the end of the program and the beginning of variables.

After the program is typed in, RUNning it will cause it to invert its own REMark statements. If the program is run again it will not convert already inverted characters back to normal.

TEXT INVERTER

```
9980 REM THIS PROGRAM SHOULD BE
9981 REM LOADED IN BEFORE TYPING
9982 REM IN YOUR PROGRAM.
9983 REM WHEN YOU HAVE FINISHED
9984 REM TYPING IN YOUR PROGRAM
9985 REM TYPE "GO TO 9989" AND
9986 REM IT WILL CONVERT ALL THE
9987 REM "REM" STATEMENTS TO
9988 REM THEIR INVERSE VIDEO.
9989 LET A = 16424
9990 IF PEEK (A) = 254 THEN GO TO 9994
9991 LET A = A + 1
9992 IF A = PEEK (16392) + 256* PEEK (16393)
     THEN STOP
9993 GO TO 9990
9994 LET A = A + 1
9995 LET B = PEEK (A)
9996 IF B = 118 THEN GO TO 9991
9997 IF B < 64 THEN LET B = B + 128
9998 POKE A, B
9999 GO TO 9994
```

SPACE VOYAGE

Stephen Meddings, Shepparton, Vic.

In this game you are flying through a swarm of Tie fighters. The way to score is to fire at them using key '0'. You score five points for the outside and ten for the centre.

If you are hit or the time runs out you change and must not hit anything except the inverse '=' which are escape pods from an exploded space craft. If you do hit anything or your time runs out again your score and hi-score are shown.

The game is saved by GOTO 500 and it will then auto-run displaying hi-score and who it is held by.

SPACE VOYAGE

```
   5 LET HS=0
  10 LET A=0
  15 LET B=15
  20 LET S1=0
  25 LET S2=0
  30 LET G=0
  35 CLS
  40 PRINT AT A,B;
  45 LET P=PEEK (PEEK 16398+256*
PEEK 16399)
  50 PRINT "V"
  55 IF P=18 THEN GOTO 165
  60 IF P=19 THEN GOTO 165
  65 IF P=21 THEN GOTO 165
  70 LET U=INT (RND*30)
  75 PRINT AT 20,U;"(+)"
  80 LET B=B+(INKEY$="8")-(INKEY
$="5")
  85 IF B<=0 THEN LET B=0
  90 IF B>=31 THEN LET B=31
  95 IF INKEY$="0" THEN GOSUB 12
0
 100 SCROLL
 105 IF G=300 THEN GOTO 165
 110 LET G=G+1
 115 GOTO 40
 120 FOR F=1 TO 12
 125 PRINT AT F,B;
 130 LET O=PEEK (PEEK 16398+256*
PEEK 16399)
 135 PRINT """";AT F,B;" "
 140 IF O=18 THEN LET S1=S1+5
 145 IF O=19 THEN LET S1=S1+5
 150 IF O=21 THEN LET S1=S1+10
 155 NEXT F
 160 RETURN
 165 LET G=0
 170 PRINT AT A,B;
 175 LET P=PEEK (PEEK 15398+255-
PEEK 16399)
 180 PRINT "$"
```

PIRATE

Frank Papadopoulos, Dulwich Hill, NSW

In this game a treasure is hidden in a 40 by 40 grid. The player is required to find the treasure in nine or less attempts.

The ZX81 picks a point in this grid between (0,0) and (39,39). However, it will not tell you where it is. It does give you a hint. After each guess it will tell you how far away you are.

As each number uses five bytes some numbers have been substituted by other methods. For example, NOT PI is equal to 0 and PI/PI = 1.

```
  10 PRINT "YOUR FIRST COURSE IN
PIRACY IS TO FIND A TREASURE."
  12 PAUSE VAL "200"
  15 CLS
  20 LET X=INT (RND*40)
  30 LET Y=INT (RND*40+2)
  40 LET N=NOT PI
  50 PRINT "GIVE YOUR X AND THEN
Y(BOTH 0 TO 39)"
  60 INPUT X1
  70 INPUT Y1
  73 LET Z=39
  75 CLS
  76 IF X1>Z OR Y1>Z THEN PRINT
"RE-ENTER"
  78 IF X1>Z OR Y1>Z THEN GOTO 5
0
  80 LET N=N+PI/PI
  90 PLOT X1,Y1+2
 100 LET D=((X1-X)*(X1-X)+(Y1+2-
Y)*(Y1+2-Y))**.5
 110 IF D=NOT PI THEN GOTO VAL "
150"
 120 PRINT (INT (D*10))/10;" PAC
ES AWAY.NEW X,Y?"
 130 IF N<=9 THEN GOTO VAL "60"
 140 CLS
 150 IF N=1 THEN PRINT "WHAT A F
LUKE..."
 160 IF N<5 THEN PRINT "HOW DID
YOU DO IT?"
 170 IF N<=9 THEN PRINT "YOU GOT
 IT IN ";N;" GOES."
 180 IF N>9 THEN PRINT "YOU'LL N
EED EXTRA PIRATE TUITION"
 190 PRINT "IT WAS AT ";X;",";Y-
2
 200 STOP
```

EXCLUSIVE ETI READER OFFER

THE "B-ETI" LOW-COST SERIAL TERMINAL

OFFER EXTENDED TO 31 JANUARY, 1984

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($247 TAX EXEMPT)
+ $10 freight
(incl. insurance)
anywhere
in Australia

By special arrangement between ETI magazine and Applied Technology, makers of the famous Microbee personal computer, we introduce the B-ETI serial terminal.

Essentially, the B-ETI makes a low-cost "glass teletype". It consists of a 'stripped-down' Microbee and supports the following data formats, all software selectible from the keyboard: 7 or 8 bit ASCII with odd, even or no parity, or Baudot (5-bit) code. Selectable data speeds of 45/50/75/110/300/200/1200 baud, no handshaking, or 2400/4800 with handshaking (pin 20 on DB25), all full or half duplex. It can also drive a parallel printer. The B-ETI emulates the popular ADM-3A and most of the 'Televideo 912' formats, making it simple to install in CP/M systems.

The B-ETI has dozens of applications with computer, and computer-related, project and equipment. It is ideal as a low-cost terminal for the ETI-690 Little Big Board computer published in the October '83 issue of ETI for example, or as part of a radioteletype system in an amateur radio station.

The screen format is 80 characters wide by 24 lines. Upper and lower case characters are available and each character key auto-repeats if held down longer than one second.

The video output can be plugged directly into one of the low-cost monitors currently available. Many of these have a 12 Vdc output socket which can power the B-ETI directly. Alternatively, it can be powered from any suitable 12 V dc source capable of supplying 700 mA. A power pack is not included. As the low-cost monitors available are generally priced at around $200 or less, *you can have a complete serial terminal for less than $500!*

This is an introductory offer. The B-ETI serial terminal has not yet been offered for sale through retail stores. When it is, it is expected to sell in the $330-$340 range so you save around 20-25% by taking advantage of this offer.

This offer is made by Applied Technology Pty Ltd (Incorporated in NSW) in cooperation with ETI magazine and ETI is acting as a clearing house for orders. All orders will be despatched by road freight for $10, insurance included, anywhere in Australia. While deliveries will be generally ex-stock, please allow up to four weeks for delivery to cover order processing and any delays that may occur.

INTRODUCTORY PRICE

90 DAY WARRANTY

The B-ETI is manufactured especially for ETI readers by Applied Technology and a full 90-day warranty is available as well as normal backup service.

APPLICATIONS

- low-cost computer terminal. Use with ETI-690 Little Big Board.
- use with modem as remote computer terminal.
- use with radioteletype (RTTY) converter/modulator in amateur radio station.

FEATURES

- 300/1200 baud operation, software selectable.
- powered from 12Vdc supply.
- low cost — only $275.
- 80 characters x 24 lines screen format.
- auto-repeat on all character keys and space bar.

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Fill out the coupon here, or a photostat of it, and enclose a cheque, bank cheque or money order for the amount required, made out to **APPLIED TECHNOLOGY PTY LTD.**
Cut out the coupon and send it to: **B-ETI TERMINAL OFFER**
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I enclose $..... total.
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Signature .....

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	ea.	10 +
P 0514 Plug	1.95	1.80
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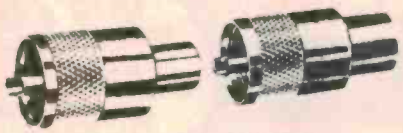

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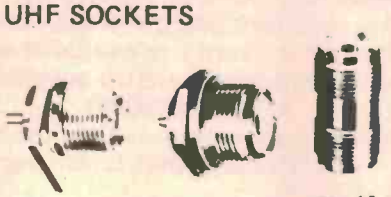

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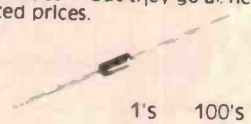

	1's	100's	1000's
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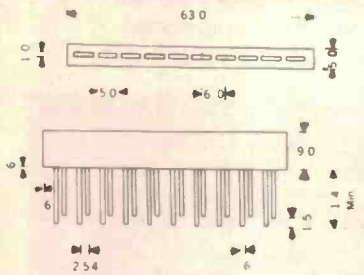

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6mm mounting hole
12mm x 12.7mm x 20mm (D)

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The H.E.M.E. 1000 is a revolutionary new instrument and a powerful new diagnostic tool for use by engineers and designers involved in setting up ac and dc motors, variable speed drives, motor vehicles, battery powered equipment, welding equipment, electroplating apparatus or equipment where surge current values are of paramount importance.

The new device registers on a digital display the maximum surge value and there is a hold facility to assist both surge and normal current values to read efficiently.

An analogue output socket permits RMS current to be displayed or monitored on a chart recorder or instantaneous examination by cathode ray oscilloscope, enabling complex current waveforms to be displayed.

The device is a clip-on, hand held, battery powered meter and as such there is no need to power down apparatus to insert ammeters. The new device from H.E.M.E. therefore makes diagnostic current measurement quicker, easier and safer than voltage measurement.

The instrument is autoranging from 0-1000 A and will operate from dc to 1 kHz, indicating polarity. Accuracy, which is ±1% of range, is only minimally affected by the position of the conductor relative to the jaws, the proximity of the return current and by stray magnetic fields from adjacent components.

Resolution is 100 mA from 1 A to 199.9 A and 1 A from 200 A to 1000 A. Display includes low battery warning, dc polarity and ac indications.

The device uses the long known Hall Effect which describes the production of a voltage when an electrical current is applied to a thin semi-conductor placed transversely to a magnetic field.

For further information contact **Warsash Pty Ltd, P.O. Box 217, Double Bay NSW 2028. (02)30-6815.**

NEW DMM

A new digital multimeter on the market is the Keithly Instruments model 175.

This 4½ digit, autoranging DMM features digital calibration and a battery option, making it fully portable.

The 175's 100-point data logger monitors drifts, determines rates of change, and collects response curve data without a printer or output cables.

The data logger has six different store rates ranging from one reading every 400 ms, to one reading every hour. Data recall is 'push-button' easy.

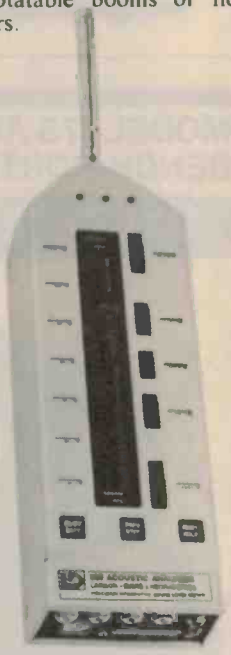
For further information contact **Scientific Devices Australia Pty Ltd, 2 Jacks Rd, South Oakleigh Vic. 3167. (03)579-3622.**

HAND HELD SPECTRUM ANALYSER

Vipac claims that it's newly released spectrum analyser, the LD800 offers the widest display range of any other available sound level meter or acoustic analyser.

Features include 60 dB span linear LED display and 10-150 dB measuring range with in-built ⅓ octave band analysis. An extensive array of peripherals consisting of calculators, software, printers, plotters and data storage devices are available from Vipac.

Accessories include the model 801 signal processor with four computer-selected microphone inputs, internal white or pink noise generators, programmable signal output levels and peripheral equipment switch channels for rotatable booms or 'floor tappers.



The Model 802 accelerometer preamplifier enables inputs from two tri-axial accelerometers (six channels total). It has programmable input sensitivities and provision for high and low impedance accelerometers with electronic integration for the measurement of displacement, velocity and acceleration.

For further details contact **Vipac Instruments Pty Ltd, 30-32 Claremont St, South Yarra Vic 3141. (03)240-841.** ▶

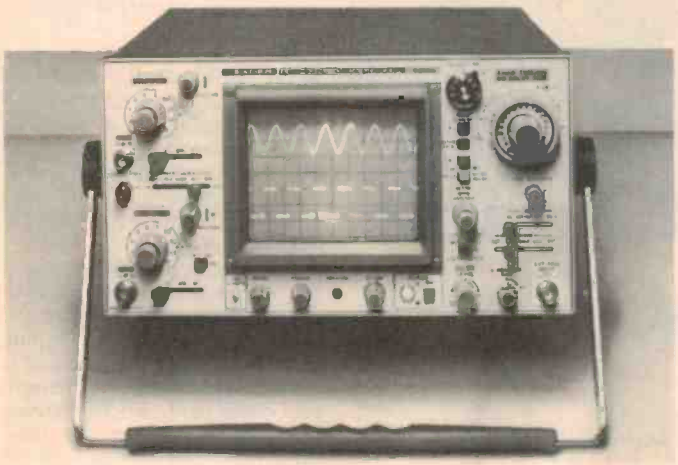
AWA's 50 MHz OSCILLOSCOPE

The LBO-525L Dual Trace Oscilloscope from AWA features a 150 mm rectangular CRT with high brightness assured by the 12 kV accelerating potential.

This Leader oscilloscope has a dc bandwidth to 50 MHz at 5 mV/div sensitivity which can be increased to 500 µV/div with a bandwidth of 5 MHz.

The signal delay line enables observation of the leading edge of fast rise time pulses and display modes include Ch.1, Ch.2, Chop, Alt, Add and Ch. 2 Invert.

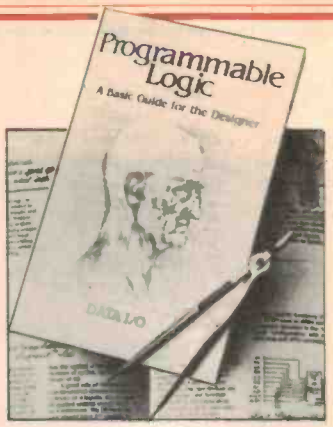
Dual time bases provide a wide range of sweep facilities including continous delayed sweep, trigger delayed sweep and alternate triggering for synchronizing two different waveforms. Sweep times are 'A' 0.2 µS/div to 0.2 S/div and 'B' 0.2 µS to 0.5 mS/div. The 10X magnifier gives a maximum sweep of 20 nS/div.



The sensitivity is 0.5 div/0.2 V p-p for both Normal and Auto up to 10 MHz and 1.5 div/0.6 V p-p up to 50 MHz. In X-Y mode the dc bandwidth is to 1 MHz, with less than 3° phase difference at 100 kHz.

The LBO-525L is supplied with two probes and available options include acccessory pouch, front panel cover, hood and rack mounting kit.

Further information available from **Amalgamated Wireless (Australasia) Ltd, North Ryde Division, Cnr Talavera & Lane Cove Roads Macquarie Park, North Ryde NSW 2113. (02)887-7111.**



FREE GUIDE

Available from Warburton Franki is a 32 page guide book published by Data, which explains programmable logic and its advantages over fixed-function LSI/MSI logic and custom logic.

The book details an actual design problem, showing how design equations are generated and translated into fuse tables and how a PAL or AFL device is programmed and functionally tested.

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- ABS IMPACT-RESISTANT CASE!
- LARGE! MEASURES 90(w) x 135(h) x 45(d)mm

SPECIFICATIONS:

DC 0 – 0.25	AC 0 – 10
0 – 10	0 – 50
0 – 50	0 – 250
0 – 250	0 – 1000
0 – 1000	AT 9,000 ohms/volt
AT 20,000 ohms/volt	

RESISTANCE	DC CURRENT
0 – 5K	0 – 0.05
0 – 50K	0 – 25
0 – 500K	0 – 250mA

dB: -20 to +22dB
BATTERY CHECK FACILITY: AA, C & D CELLS
ACCURACY: DC +/–3% F.S. AC +/–4% F.S.
OHMS +/–3%
BANANA PLUG PROBES AND BATTERY INCLUDED
This is an unbelievable meter bargain. Normally this unit would sell for around $25. Japanese made quality.
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NORMALLY (a low price anyway) ~~$17.95~~

THIS MONTH **$15.95** SAVE WELL OVER 10%

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This is the 650 volt version (for extra safety) of the C122E SCR which we use in the popular 'Fluorescent Lamp Starter' Kit as described in October 1982 EA. Normally $1.50 each. This month only $0.95 each! (Minimum 5 pieces). Makes the Fluoro starter kit very cheap!
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Complete with data sheet, instructions and wall hanger bracket.

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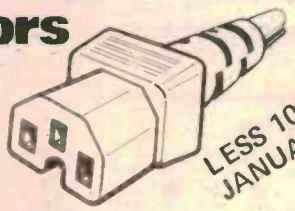
IEC Cable Connectors

Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains-powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords. We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous.



LESS 10% FOR JANUARY ONLY

Cat. No	Description	Price
PS4302	LINE CORD STRAIGHT ENTRY 2M	$3.95
PS4304	LINE CORD R/HAND ENTRY - 2M	$3.95
PS4305	LINE CORD L/HAND - 2M	$3.95
PS4306	LINE CORD STRAIGHT ENTRY WITH 240V PLUG - 2M	$4.95
PP2302	IEC 320 CHASSIS PLUG	$2.95
WM4530	2 PIN 240V PLUG MOULDED TO 2M FIG. 8 7.5 AMP CORD - BLACK IN COLOUR	$2.95

(Note: the first 5 items are grey in colour)

low cost IC inserters AND EXTRACTORS

Up until now these have cost a fortune!!
Features:
- **CMOS SAFE conductive plastic**
- **Exclusive bent pin alignment guides in handle. 8 to 40 pins.**
- **Ground strap can be connected.**
- **One hand operation.**

INSERTERS

Cat. No	Model	Description	Normally	NOW
TH1810	CIT820	8 – 20 pin	$5.95	$4.16
TH1812	CIT22	22 pin	$6.50	$4.55
TH1814	CIT2428	24 – 28 pin	$6.95	$4.86
TH1816	CIT3640	36 – 40 pin	$8.95	$6.26

EXTRACTOR TH1818 ET480
Deceptively simple looking device. One piece metal construction. 8-40 pins $2.95 NOW $2.06

30% OFF JANUARY

MOTOROLA CMOS DATA

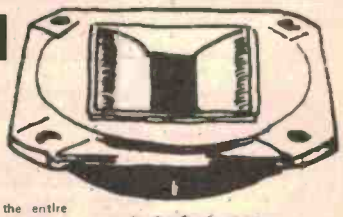
Normally $14.50

NOW ONLY $9.95

862 pages crammed with up-to-the minute information on 4000, 4400, 4500 devices. A complete product index is included along with comprehensive data on every device (almost 200 described). As the part numbering system is standard, you can use this reference for other manufacturers products with the same generic numbers. This book normally sells for $14.50.
Cat. BM-4210

RIBBON tweeter

SAVE $16.95



Unique regular phase design drives the entire diaphragm, uniformly and completely in phase over the full frequency range. The performance of an electrostatic speaker with the ruggedness and ease of use of a dynamic.
Cat. CE-2042 NORMALLY $36.50 ea

ONLY $19.95

- 91dB sensitivity
- 50W system power
- 5,000-40,000Hz
- No voice coil

10-50% OFF SALE!!

SAVE A FORTUNE!

LOW COST DIGITAL MULTIMETER KIT

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it considering the fine low-cost built up units available. The DP2010 changed all that.
This kit, fully imported from the UK uses the famous DPM-05 custom LCD/Voltmeter to achieve phenomenal accuracy at very modest cost!
All parts are included to complete the meter including an attractive and colourful front panel.
(a 9V battery is required)

Set of test probes to suit $2.95
Probe to suit Cat. WT5312 ONLY $2.50
Eveready 216 (red) 9V Battery Cat. SB2370 ONLY $1.40

SAVE OVER 15%

DP2010 kit Cat. KJ7010 ONLY $45

SPECIFICATIONS

AC VOLTAGE AND CURRENT RANGES
When S3a selects a.c. functions the output from either the voltage attenuator or current shunts is fed through C1 to remove any d.c. component.

Function	f.s.d.	Resolution	Accuracy	Protection
Volts (d.c.)	2V	1mV	1%±1 digit	500V for
	20V	10mV	1%±1 digit	one minute
	200V	100mV	1%±1 digit	
	500V	1V	1%±1 digit	
Current (d.c.)	2mA	1uA	1%±1 digit	1A/250V
	20mA	10uA	1%±1 digit	
	200mA	100uA	3%±1 digit	
	2000mA	1mA	5%±1 digit	
Volts (a.c.)	2V	1mV	2%±5 digit	500V for
	20V	10mV	2%±5 digit	one minute
	200V	100mV	2%±5 digit	
	500V	1V	2%±5 digit	
Current (a.c.)	2mA	1uA	2%±5 digit	1A/250V
	20mA	10uA	2%±5 digit	
	200mA	100uA	4%±5 digit	
	2000mA	1mA	7%±5 digit	
Resistance	2K	1	1%±1 digit	260V r.m.s.
	20K	10	1%±1 digit	
	200K	100	1%±1 digit	
	2000K	1K	1%±1 digit	
Diode Test	2V	1mV	1%±1 digit	260V r.m.s.

AMAZING VALUE WAS $45 THIS MONTH SAVE... **$37.95**

SPRAY ON CONDUCTIVE PLASTIC... $6.95

This handy 200 gram spray enables you to do all manner of things. You can spray sheets of Styrene foam and make them suitable for storing your MOS IC's. Far cheaper than other methods!! You can make conducting screens inside plastic boxes to shield RF. You can re-coat the back of CRT's. You can make conductive parts of equipment cabinets to reduce static. The paint dries to a hard varnish like film. Non-inflammable and Non toxic. Grab a can now. You never know when you will need it!
Cat. NA-1010 – $6.95

115 VOLT COMPUTER FANS

$12.95 THIS MONTH

NORMALLY $14.95

We have made a scoop purchase of computer grade Box Fans. They measure a standard 80 x 80 x 40mm. But there's a catch! They are only available in 115V! Great if you are making equipment for export to the USA – or use 2 in series! No problem!
Cat. YX-2508 ONLY $14.95

SAVE $2.00 OR OVER 10%

Lyrebird Piano Kit

REF: EA 11/81-1/82

GREAT NEW FEATURES!!
- FREE! A stand (like the one illustrated but not exactly the same). Worth around $50 but yours at no extra charge with each 73 or 88 note kit.
- FREE! A soldering iron (worth around $19). Yours to keep to give years of faithful service after you have completed your Lyrebird. (88 note only)
- FREE! A 200g roll of solder. You will need some to build the Lyrebird but there will be plenty left over for other projects. (73 & 88 note versions).
- FREE! Quality IC sockets provided in both kits.

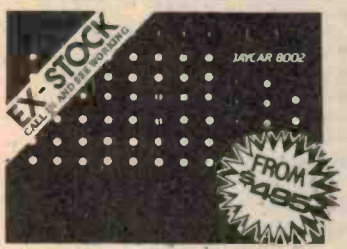
HUNDREDS SOLD!!!

REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

The stand that we provide for the piano kit is not the same as the one shown in the illustration.

88 NOTE VERSION
NORMALLY $589
THIS MONTH $489
SAVE $100!!

73 NOTE VERSION – NORMALLY $475
THIS MONTH $425 – SAVE $50!!



8 CHANNEL MIXER KIT

SAVE JANUARY ONLY

Ref: EA March/April 1983
This great 8 channel 'live' mixer is perfect for bands, churches, theatre groups, home recording, disco etc.
Each input channel accepts either microphone (balanced) or line (1V) levels. Powerful equalisation foldback effects facilities are provided. The left and right master channels can drive balanced or unbalanced lines with 5 band "graphic" equalisation. Separate foldback and "effects" are provided.
The unit can be rack mounted or housed in a console chassis (which accommodates the power supply). Attractive wooden end-pieces finish the console to form a professional looking unit.

FREE!! Console mount chassis and power supply INCLUDED FOR $495! NORMALLY $98 EXTRA

$495 **AMAZING VALUE**

TWIN SCREENED AUDIO CABLE

Twin screened round audio cable. (Two screened conductors NOT fig. '8')
This cable normally sells for $0.48/metre or $42.00/roll.

Cat. WB-1504 $20.00/roll

$20.00 PER ROLL SAVE OVER 50%..

10" ELECTRIC GUITAR SPEAKER

Quality Pioneer brand check the specs! Check the price!!
HURRY

Impedance	8 ohm
Voice Coil Dia.	1½ (inch)
Power Rating	60 WATT (RMS)
Resonant Frequency	80Hz
Sensitivity	98 (dB/W)
Response	80Hz - 7,000Hz
Total Flux	61,100 Maxwell
Flux Density	8,300 Gauss
Net Weight	1,540 gm

$29.95

VARISTORS PROTECT LOW VOLTAGE CIRCUITS

Fabricated from zinc oxide, GE-MOV II varistors can protect sensitive, low voltage devices like microprocessors, from transient voltages that can cause malfunctions and failures.

By increasing the size of the material's grains, General Electric was able to obtain a low voltage rating without making the metal-oxide wafer too thin and thus too fragile to make. Each grain represents a potential of between two and three volts.

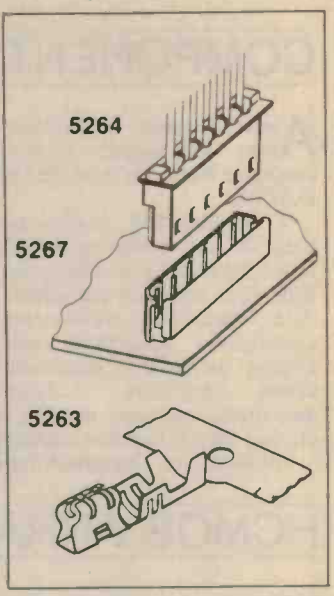
The devices are suitable for use in data-communciations systems, business machines, electronic games, personal computers and also instrumentation systems.

The company claims that these zinc-oxide varistors perform better than silicon devices in overstress situations, continuing to deliver a degree of functional transient protection even when pushed beyond normal limits.

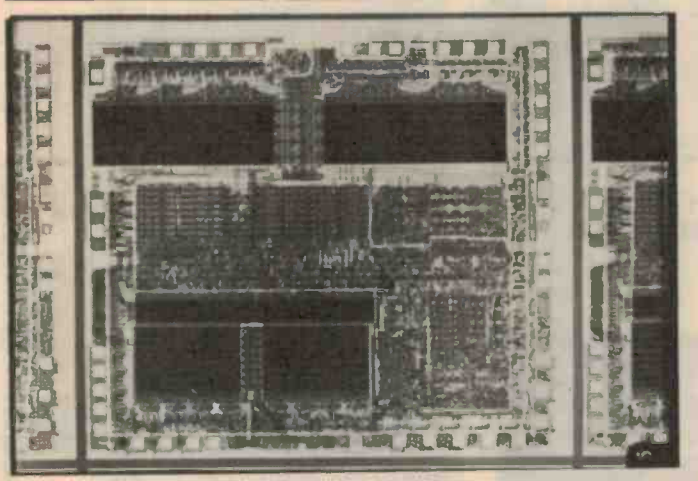
The low-voltage device, the V8ZA1, is rated for protection against 0.4 J, 100 A transients. At a 1 mA test current for an 8 to 20 second duration, the voltage supressor has a 22 V maximum clamping voltage.

Also available is a high-energy GE-MOV II varistor, rated to 70 000 A and 1000 J. This device is available in 13 voltage ratings from 420 to 2800 V and 560 to 3500 V dc.

For further information contact **General Electric, P.O. Box 174, Willoughby NSW 2068. (02)888-8111.**



PHILIPS MATCHES INTEL'S 8051



An alternate source for Intel's 8051 is offered by Philips complementing its present family of MAB8048H 8-bit microcontrollers.

This latest addition to the range, the MAB8051, offers extended on-chip memory capacity, enhanced architecture and a larger instruction set.

Fabricated in HMOS, it is now available in a single, 40-pin plastic DIL package (SOT-129) from Philips' Hamburg factory.

The MAB8051 8-bit microcontroller is a single chip device designed for stand-alone use in real-time applications such as instrumentation, industrial control and intelligent computer peripherals.

Hardware features of the MAB8051 include 4K of programmable, non-volatile ROM (extendable to 64K); 128 bytes of volatile RAM for data storage (extendable to 64K); four 8-bit ports and 32 I/O lines; two 16-bit timer/event counters; a five-source, two-priority level, nested interrupt structure; a full duplex serial port and on-chip oscillator and timing circuits.

Extra capability, in the form of standard TTL compatible memories and logic can be added.

Architectural enhancements allow the device to function as an arithmetic processor, with facilities for both binary and BCD arithmetic plus bit-handling capabilities.

To further enhance the series, both a CMOS version and a CPU-only version (needing external ROM) are expected early in 1984.

For further information contact **Philips Electronic Components & Materials, 67 Mars Road, Lane Cove NSW 2066. (02)427-0888.**

CMOS 14 DIGIT LCD DISPLAY DRIVER

Sharp's new programmable CMOS LCD driver interfaces serially with your CPU to directly control and drive liquid crystal displays in static or dynamic mode.

The LH5008 may be operated in ½, ⅓ or ¼ duty cycles to yield up to 14 digits of a 7-segment display or eight digits of a 14-segment display.

Features include a blinking mode and an 8-bit serial character input.

The 7-segment drive mode outputs numerics 0-9 and six symbols, whereas in the 14-segment driver mode, 36 alphanumerics and 13 symbols may be addressed.

Packed in a compact 60 pin flat pack, the LH5008 is compatible with the UPD 7225.

For further details contact **Philip Jackson or Joanne Oxley, Daneva Australia Pty Ltd, P.O. Box 114, Sandringham Vic 3191. (03)598-5622.**

LOW PROFILE PC BOARD CONNECTOR

Latest in the Molex range, distributed in Australia by Utilux, is a very low profile 2.5 mm centreline Mini-Spox connector housing of special interest for manufacturers and assemblers of radios, stereos and video cassette recorders.

Only 8 mm high and 3.9 mm wide, the 94V-0 nylon connector housing has moulded-in pull tabs, polarisation, frictionlock, and provides for 2-15 circuits in line. Catalogue number is 5264.

Also released for use with the 5264, is the 5263 spring-box type crimp terminal. Of pre-tinned phosphor bronze, the pin contact area is inside the box, which prevents contamination from handling during the assembly process. Available in continuous strip or loose form, it accommodates AWG 22-28, with an insulation diameter of 1.9 mm maximum.

An assembled connector made up of the 5264 housing and the 5263 terminal, mates with the Molex 5267 straight or the Molex 5268 right-angle, fully-shrouded Mini-Spox headers.

Both hand and semi-automatic crimp tooling are available from Utilux.

For further information contact **Utilux Pty Ltd, 14 Commercial Road, Kingsgrove NSW. (02)50-0155.** ▶

COMPONENT CATALOGUE

A new, 376 page data conversion component product catalogue has been produced by DATEL.

It contains full engineering data on the following monolithic, hybrid and modular products: A/D and D/A converters, data acquisition subsystems, sample-hold amplifiers, operational amplifiers, instrumentation amplifiers, isolation amplifiers, analogue multiplexers and special function circuits.

Products are organised into quick selection tables that are arranged by function and performance to ease product selection for any given application. Complete data sheets are included for key products along with tutorial information and an ordering guide.

A copy may be obtained by request on an official organisation letterhead to: **Elmeasco Instruments Pty Ltd, P.O. Box 30, Concord NSW 2137. (02)736-2888.**

HCMOS ARRAYS

Motorola has introduced a family of four HCMOS Macrocell Arrays; the HCA6348 with 4860 equivalent gates, the HCA6324 with 2295 equivalent gates, the HCA6312 with 1200 equivalent gates and the HCA6306 with 648 equivalent gates.

The arrays are processed in three micron silicon gate CMOS two layer metal technology, which yields typical loaded on-chip gate delays of 2 ns. Input buffers operate at either TTL or CMOS voltage levels and output buffers are capable of driving ten LSTTL loads.

DATEL

Data Conversion Components

National Semiconductor is Motorola's fully compatible alternate source for HCMOS, ALS and ECL Macrocells Arrays.

A variety of standard packaging is available ranging from 28 pin DIL packages to 124 terminal leadless chip carriers, pin grid arrays and chip carriers.

For more information contact **Motorola Semiconductor Products, 250 Pacific Hwy, Crows Nest NSW 2065. (02)438-1955.**

OP AMP

Teledyne claims that its new chopper stabilised op amp, the TSC 7650 practically removes offset voltage error terms from system error calculations.

The 5 μV maximum Vos specification represents a 15 times improvement over the industry standard OPO7E and the 50 nV/°C offset drift is over 35 times lower than the OPO7E, they say.

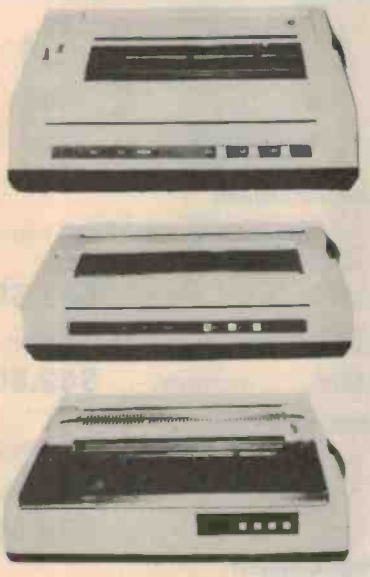
The TSC 7650 uses an elegant feedback technique whereby an auxilliary on-chip amplifier continually senses input versus output errors on the main amplifier and supplies a correction signal.

The IC features input offset voltage typical of 0.7 μV, input bias of max 10 pA, an open loop gain of 120 dB min, a 20 mW power drain, a 2.5 V/μs slew rate and is accommodated in eight pin or 14 pin DIL packs.

For further information contact **Promark Electronics, 6 Clarke St, Crows Nest NSW. (02)439-6571.** ●

C. Itoh PRINTERS

FROM ROD IRVING ELECTRONICS



Pro/Writer Printer 8510

Print Features: Number of columns—136 col. max. Print Speed—120 CPS. Print Direction—Single-directional and Bidirectional, Switch Selectable. Throughput Speed—From 44 to 152 lpm. Character spacing (max. number of columns per line)—Pica 10 CPI (80), Double Width 5 CPI (40), Compressed Font 17 CPI (136), Double Width 8.5 CPI (68), Elite 12 CPI (96), Double Width 6 CPI (48), Proportional Double Width Proportional Line Spacing—Variable to 1/144". Print Width—203 mm (8") max.
Forms Type: Fan Fold Roll or Cut Sheet: Width—113 mm to 254 mm (4.5" to 10.0"). Total Thickness—0.05 to 0.28 mm (0.002" to 0.011"). Number of Copies—Original + 3 copies nominal.
Form Feed: Method—Tractor or Friction. Form Loading—Either rear or top.
Interface—Serial: Method—EIA RS232-C and 20mA (40 & 60mA switchable option) Current Loop Serial Interface. Baud Rate (BPS)—110, 300, 600, 1200, 2400, 4800, 9600. Transmitting Method—Half Duplex. Synchronisation—Asynchronous.
Interface—Parallel: Method—TTL compatible, 7-bit, parallel interface. Control Signals—ACK, BUSY, SELECT, DATA STB, INPUT PRIME FAULT, INPUT BUSY, PAPER EMPTY.
Instruction Codes—(ASCII): CR, LF, VT, FF, CAN, SO, SI, DEL, DC1, DC2, DC3, DC4, GS, RS, US, FS, EM; GRAPHIC SYMBOLS; BIT GRAPHICS.
Error Detection: (1) Parity (VRC)—Odd, Even, No-parity. Switch selectable. **(2)** Framing Error—Stop bit check. **(3)** Overrun Error—Error is detected when data are received before the previous data have been processed.
Physical dimensions: 396 mm W x 120 mm H x 285 mm D (15.7" W x 4.7" H x 11.2" D).
Weight: 8.5 kg (18 lbs., 12 oz.)

Model 1550

The Model 1550 is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.
The character format is a dot matrix of 7(H) x 9(V), or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 136 characters can be printed per line at 10 CPI.
Its main features are: • Compact desk-top dot matrix printer • 136-column print • Lightweight • Low power-consumption • High-quality print • Bit image graphics • Graphic Symbols • Prints in six different languages • High reliability • Low cost.

F-10 Printmaster Daisy Wheel Printer

Print Speed: 40 CPS. **Print Method:** Static Print Impact. **Number of Printable Columns:** 136, 163. **Variable Character Spacing:** 1/120 inch (minimum). **Line Spacing:** 1/48.
Return Time: 300 msec. **Line Feed Time** 40 msec. **Paper Width:** 406 mm (maximum).
Print Characters: 96. **Printwheel:** Industry Standard 96 Character Wheel. **Interface:** Industry Standard 8-bit Parallel, RS232-C Compatible, X-ON, X-OFF, 12-bit Qume and Diablo Compatible. **Dimensions:** 574 mm W x 405 mm d x 183.5 mm H (22.5" W x 15.9" D x 6" H). **Weight:** 14 kg (30.8 lbs.) with cover and power supply. **Noise:** Less than 65 Db (1M from Platen, A Scale).

tax exempt

P* $795 ($695)
S** $1095 ($945)

P* $1095 ($995)
S** $1395 ($1295)

P* $1950 ($1675)
S** $2100 ($1775)

* Parallel Interface ** Serial Interface

ERRORS AND OMISSIONS EXCEPTED

NEW VIDEO MONITORS

Get a clear honest image!

Computer data and graphic displays never looked better, brighter, sharper

High Resolution

- Recommended Display Characters: 1920 (80×24).

GUARANTEED for 12 months by Rod Irving

SCHOOL AND CLUB BULK BUYS
Please ring for pricing

- High quality, non-glare CRT
- Compact and Lightweight with all Controls inside Front Panel.
- All units 100% Factory Burned-In.
- 800 lines centre resolution.
- Suitable for Apple® — and other computers. (Apple is a registered trademark of Apple Computer Computer, Inc.)
- Green or Orange Phosphor available.
- 18 MHZ.
- First Shipment arriving middle of June, 1983.
- Direct import Price for June

Green Phosphor $199 ($179 Exempt)
Orange Phosphor $229 ($189 Exempt)

GREAT VALUE Ex Stock

THE PRINTER PEOPLE'S SPECIALS

Just Arrived

A NEW PRINTER NOW!

CP-80/I, 80-COLUMN IMPACT PRINTER

SPECIFICATIONS

Functional Specifications

Printing method — Serial impact dot matrix
Printing format — Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal: 640 dots serial/line
Character size — 2.1mm (0.083")-W x 2.4mm (0.09")-H/7 x 8 dot matrix
Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics
Printing speed — 80 CPS. 640 dots/line per second
Line feed time — Approximately 200 msec at 4.23mm (1/6") line feed.
Printing direction — Normal — Bidirectional, logic seeking. Superscript and bit image graphics — Unidirectional, left to right
Dot graphics intensity — Normal — 640 dots/190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190mm (7.5") line horizontal
Line spacing — Normal — 4.23mm (1/6").
Programmable in increments of 0.35mm (1/72") and 0.118mm (1/216")
Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed/double width — 71 columns. The aboves can be mixed in a line
Paper feed — Adjustable sprocket feed and friction feed
Paper type — Fanfold. Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").
Number of copies — Original plus 3 copies by normal thickness paper

Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use), black
MTBF — 5 million lines (excluding print head life)
Print head life — Approximately 30 million characters (replaceable).
Dimensions — 377mm (14.8") -W x 295mm (11.6") -D x 125mm (4.9")-H incl. sprocket cover.

Parallel CP80 $449
Serial CP80 $599

Bankcard mail orders
ORDER FORM
Please Debit my Bankcard
No.....
Expiry Date.....
Name.....
Signature.....

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
Minimum P & P $3.00.
Please address tax exempt, school, wholesale, and dealer enquiries to:
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923 Telex AA 38897

QUALITY VIDEO KITS

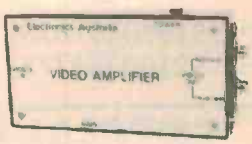
Video has been booming for quite a while, finally a range of video accessories in kit form.
Two **video amplifiers** for both VCR and Computer use, a brand new **Video Enhancer** and our popular VCR **Stereo Synthesizer**. All four represent outstanding value for money and all are assembled with Altronic's **Extra Care.**

VIDEO AMPLIFIERS

DISTRIBUTION TYPE
Simple, low-cost project will allow you to drive five video monitors from one source, such as a video cassette recorder or a computer. Great for piping video around the house, or for clubs meetings when screening lectures etd, or for computer demonstrations.

★ **THE ALTRONICS KIT** includes all components as specified by ETI **plus all** power supply components.

K5830..... Only..... **$45.00**



SINGLE OUTPUT

INVERSE AND NORMAL OUTPUT
Brilliant new kit from EA. **Super cheap** and **Super Effective.** Whilst our K5830 is suitable primarily for VCR use this video amplifier is best suited to use with computers. The EA documentation supplied is extremely well written and provides details for installation into television sets.

NO MORE SMEARY COLOURS, SIGNAL BEATS OR RF INTERFERENCE

NOTE ★ NOT SUITABLE FOR USE WITH LIVE CHASSIS TV SETS.

K5850..... **$14.95**

VIDEO ENHANCER

Here's a **simple** but **effective** Video Enhancer that is super **easy to build** at a fraction of the cost of commercial models.
Unit sharpens picture detail, and can actually improve the quality of a copy by amplifying the top end of the video signal.

AT LAST A VIDEO ENHANCER KIT

K5825..... **$35.00**

ENJOY THE PLEASURES OF STEREO SOUND
(See EA Sept. 1982)

STEREO SYNTHESIZER FOR VCR'S AND TUNERS

Synthesize realistic stereo from virtually any monophonic source by simply connecting this unit between the source and your stereo amplifier.

- ★ Quality Phillips MN3001 (not second source dropout).
- ★ Provision for 2 different signal sources.
- ★ Selection of either source via front panel switch.
- ★ Normal or stereo sound selection.
- ★ Complete kit includes all hardwear, cables etc., even solar.

Important ★ beware of kitset suppliers who sell this kit for less ★ you get less!

K5810..... **$55.00**

FUNCTION GENERATOR

The most essential piece of test gear (second only to a good multimeter) on any hobbyist's bench is some kind of audio signal generator. This design utilizes the latest circuit techniques to produce stable, low distortion waveforms.

A truly versatile unit at a bargain price.

4 digit frequency readout (eliminates tiresome dial calibration) — typical accuracy ± 2% - 5 overlapping ranges ±9, ±90, ±100 — 600 Ohm Nominal Output — continuously variable 3Wv — 2.5V P-P Distortion — sinewave less than 0.7% @ 1KHz — Linearity — triangle wave better than 1% @ 1KHz — Squarewave rise time — 6V/uS maximum output — Amplitude stability — better than 0.1dB on all ranges.

With the exception of the display all components mount on a single PCB making this kit suitable for all constructors.

K2505..... **$85.00**

DIGITAL CAPACITANCE METER

With Deluxe Instrument Case

NEW DELUXE FINISH
We are pleased to announce the release of the Digital Capacitance Kit housed in our Deluxe HQ480 ABS Instrument Case.
This superb Test Instrument kit now compliments our top selling Digital Frequency Counter and Function Generator Project kit. Electronics Australia Project. Measures capacitance of both polarized and non-polarized capacitors from 1 picofarad to 99.99 microfarads in 5 ranges.
Check values of unmarked capacitors, especially those little trimmers that are never coded.
Select precise values for filters and timing networks within ease.

EXCLUSIVE TO ALTRONICS
Each kit includes precision measured capacitors for accurate calibration of each range.

K2521..... **$55.00**

7 DIGIT FREQUENCY COUNTER

UNBELIEVABLE 0.005% ACCURACY

Frequency and Period measurement to 500 MHz (with optional prescaler) High input sensitivity. Professional unit at a fraction of the cost of built up units.

IC sockets provided throughout - Low age rate 10 000 MHz XTAL - Quality ABS plastic case with deluxe front panel - Specified LSI.

K2500..... **$119.50**

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K2501..... **$26.00**

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K2502..... **$7.50**

THE EVER POPULAR MUSICOLOUR IV EA PROJECT

Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

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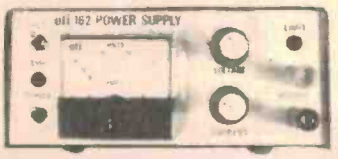
POWER SUPPLIES

If you're thinking of buying a power supply then buy from us, we are the experts on power supply kits and carry a supply to suit most enthusiast and professional requirements..... READ ON.



BENCH STANDARD
- ★ 3-30v Output @ 1 Amp.
- ★ Fully Regulated, Fully Protected from Thermal Overload and Short Circuits.
- ★ Based on EA Design.

K3200..... **$42.50**

- ★ All the features of above PLUS Current Limit.
- ★ ETI Design.

K3205..... (PICTURED)..... **$49.50**

DUAL TRACKING
- ★ ± 1.3 to ± 22v Output @ 2 Amps. + 5v @ 0.9 Amps.
- ★ Fully protected.
- ★ 10 turn pot enables voltage adj. to within 10mv.
- ★ EA Design (March '82).

K3220..... **$89.50**

HIGH CURRENT

MICROCOMPUTER PS
★ + 5 Volts @ 3 Amps. ★ + 12 Volts @ 2 Amps. — 12 Volts @ 200 milliamps.
This universal design has enough grunt to power most disk drives.

K3350..... **$59.50**

13.8 VOLTS @ 10 AMPS HAM'S & CBER'S
Save the expense of a Mains Powered Rig.

K3250..... **$89.50**

HIGH CURRENT — DUAL METERING

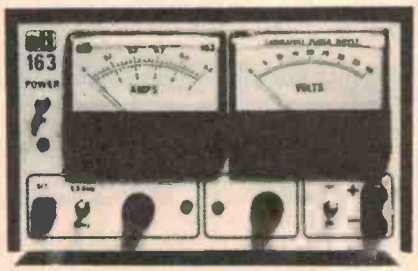
EA SWITCH MODE DESIGN
- ★ 2-50 Volts at massive 175 Watts.
- ★ CLEVER DESIGN — a fully mains isolated supply with a "Switchmode" low voltage circuit.
- ★ Easy to build.

K3300.. (EA MAY, JUNE '83).. **$139.00**
K3301... (10 TURN VOLTAGE CONTROL OPTION)... **$10.00**
K3302..... (± 12V OPTION) EA JULY '83..... **$12.50**

ETI SERIES REGULATOR DESIGN
- ★ 0-40 Volts @ 5 Amps — **thats 200 Watts.**
- ★ Current limiting 0-5 Amps variable.
- ★ Specifications Second to None.
- ★ Free from the hum and noise sometimes associated with other techniques.

A PROFESSIONAL SUPPLY

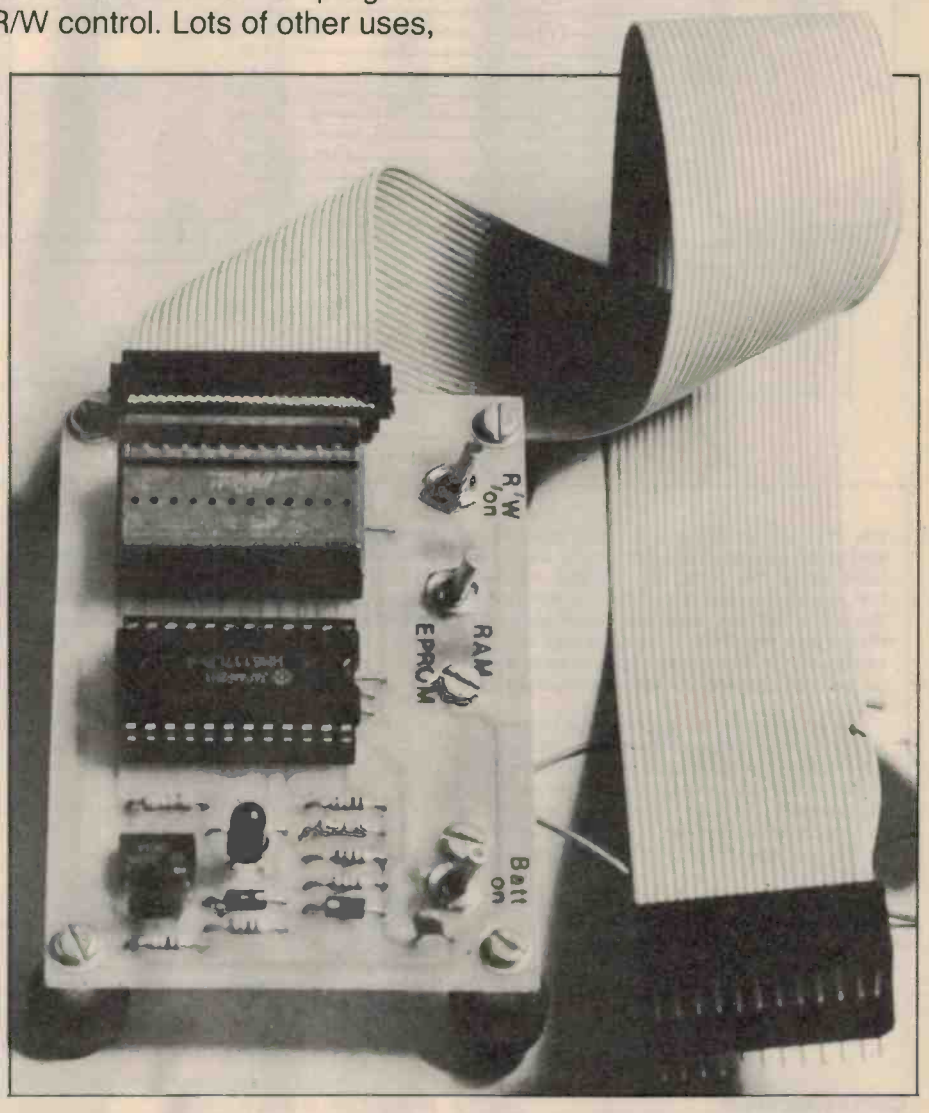
K3325.... (PICTURED).... **$175.00**



The program bug debugger

Ever burnt a program into an EPROM and found it wouldn't run? Without a logic analyser it's nigh on impossible to debug. This project costs far less than a logic analyser and gets you out of the jam. The Bug Debugger provides 'mirror image' RAM (battery-backed if you like), permits the addition of program breakpoints and interception of R/W control. Lots of other uses, besides.

Graeme Teesdale



MANY MICROCOMPUTER programmers would have, at some time or another, experienced the situation where, having written a program in CP/M or assembler, burnt an EPROM from the hex listing, placed it in the board and executed a test run — to find nothing has happened!

Shriek, expletive deleted, tearing of hair, pounding of bench, attacking of keyboard, recitation of magic incantations, utterances such as "bother!" and like manifestations of frustration rend the air on such occasions.

Without a logic analyser, it is difficult to debug the unit. However, if you could load the contents of the EPROM into a mirror image RAM where breakpoints can be inserted and R/W control removed, debugging is possible.

This project is designed to produce the hardware for the system which will plug into a standard 2716/2516 EPROM socket. Depending on the microprocessor used, you may need to write a short memory-block move routine. Many micros have such a command in their primitive VDU monitor software.

The project hardware can be used in three ways:

(1) As a temporary extension socket for existing EPROM.

(2) For additional RAM, using the extra *chip select*: In this mode the existing EPROM is placed into the debugger board so that the flying lead CS2 can be inserted into the original socket.

(3) As a mirror RAM debugger. In this mode the chip select switch is set to RAM position and the R/W switch off. The result is a volatile ROM (non-volatile if battery-backup is used).

With battery backup, the program can be stored in the RAM for many months as the current drain is very, very low (less than 5 μA; the prototype was measured at 3.2 μA).

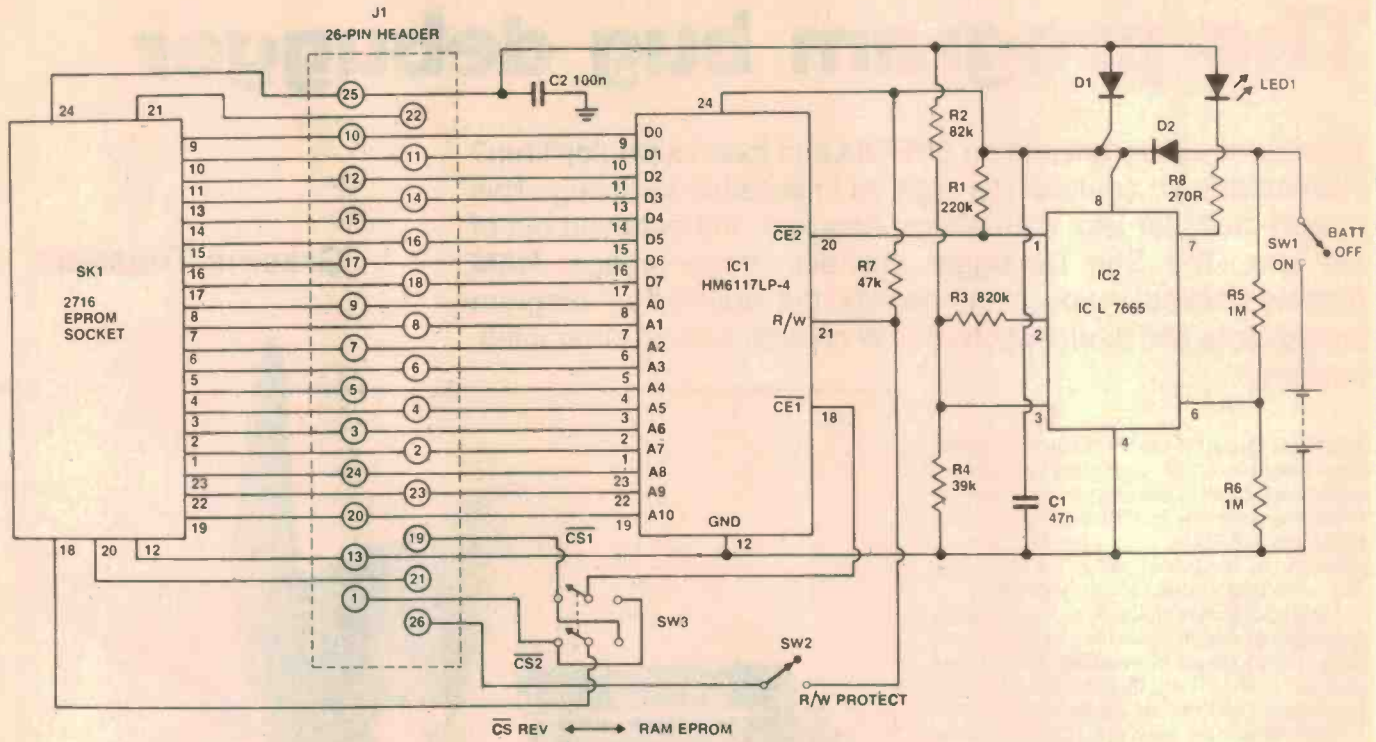
Design details

The circuit makes use of a Hitachi CMOS 2K x 8-bit RAM chip, type HM6117LP, and an Intersil micropower under/over-voltage detector, type ICL7665. The HM6117LP is a version of the HM6116LP, the previously used *output enable* line (OE), pin 20 is a second *chip select*, CS2, in the 6117, and acts as a *de-select* pin on power-down.

With the 6116, on power-down it is necessary to have pullup resistors on the address and data lines, determining input status, to obtain minimum standby current. Also, additional gating of WE and CE1 is required. The very low price differential between the 6117 and the 6116 made the former the obvious choice for this project.

The ICL7665 contains two individually programmable voltage detectors on a single chip, referenced to an internal 1.3 V source. The outputs from the two voltage comparators drive four open-drain FETs. Out 1 (pin 1) and Out 2 (pin 7) are N-channel, Hyst 1 (pin 2) and Hyst 2 (pin 5) are P-channel.

Each section is independent of the other but both use the same 1.3 V reference. The input impedances of the two inputs, Set 1 and Set 2, are each extremely high, with typically 10 femptoamps (0.01 nanoamps!) leakage current. Total current drawn by the 7665 is very low, typically 2.5 μA. The output MOS transistors are capable of sinking and sourcing LED currents, a fact I made use of here to indicate battery voltage. ▶



HOW IT WORKS — ETI-656

The 2716 socket SK(1) is a direct copy of the socket the project plugs into on the microcomputer board. The RAM, IC1, requires additional R/W and chip select lines from the main board. The rest of the data and address lines are bussed across from the EPROM socket except for pin 20 and pin 18. Pin 20 is controlled from an output on the over-voltage detector and is normally at logic '0'.

The set input on the over-voltage comparator is taken to the centre of the voltage divider (R2-R4) between the +5 V rail and 0 V. Hysteresis is added to the over-voltage comparator to reduce the possibility of false switching or oscillations as a result of fluctuations in the supply rail down to the top switching point. The upper switch voltage is:

$$V_H = \frac{R4 + R2}{R4} \times 1.3$$

$$= \frac{82k + 39k}{39k} \times 1.3$$

$$= 4.03\ V$$

The lower switching point is below the voltage where the Out 1 MOS transistor is off. Resistor R1, in this case, is used as a pullup resistor, pulling pin 20 of IC1 up to the supply rail. For data retention, pin 20 must be within 0.2 V of the voltage on the supply rail — pin 24 of IC1. The lower switching point is:

$$V_L = \frac{R4 + \frac{R2R3}{R2 + R3}}{R4} \times 1.3$$

$$= \frac{39k + \frac{82kx820k}{82k + 820k}}{39k} \times 1.3$$

$$= 3.78\ V$$

The undervoltage comparator is used to monitor the battery voltage. When it's below the setpoint, the Out 2 MOS transistor is on, switching the LED on. The LED *only* indicates battery condition when the project is plugged into the EPROM socket on a micro board and is deriving supply from there.

The under-voltage trip voltage is given by:

$$V_u = \frac{R6 + R5}{R6} \times 1.3$$

$$= \frac{10^6 + 10^6}{10^6} \times 1.3$$

$$= 2.6\ V$$

Diodes D1 and D2 are used as blocking diodes, isolating the +5 V and battery supplies from one another. The only precaution recommended by the manufacturers of the ICL7665 (Intersil) is decoupling very close to the supply pins.

Under certain circumstances, like very rapidly increasing power supply input, the four-layer PNPN type structure of the chip can latch-up, drawing excessive supply current. The problem is more likely to happen when the Debugger's battery is switched on before the Debugger is plugged into the microcomputer's power supply. Generally, growth and decay of the micro's +5 V supply would have a much longer time constant, presenting no problem.

Construction

Before commencing assembly, check the printed circuit board for shorts between tracks — particularly the data and address lines, no matter whether you've purchased a ready-made board or etched your own. A visual check alone may not show hairline shorts, so use an ohmmeter or continuity checker. Also check that all the holes have been drilled to the correct diameter.

I used a Scotchcal label to indicate the switch functions on the board. If you're making your own, do it now. Attach the label to the appropriate position on the board, which can be seen from the accompanying photograph.

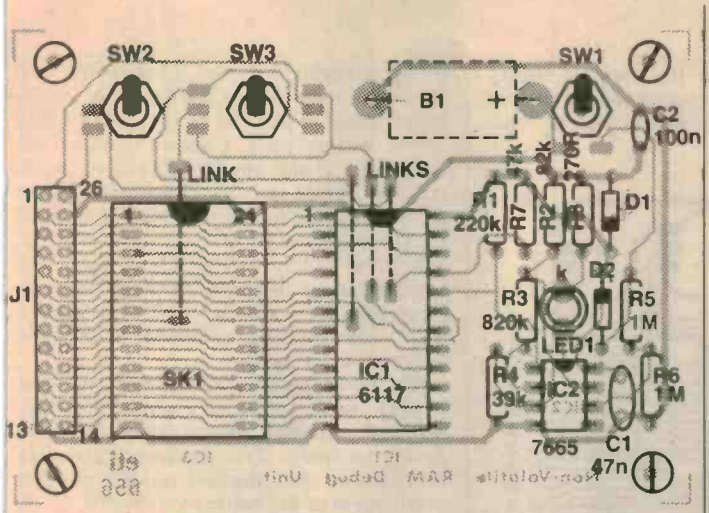
The first thing to do is solder the four links in place. Use 22g tinned copper wire.

Start component assembly by mounting J1, the 26-pin header plug strip, followed by the IC socket and the EPROM socket (SK1). I used a low insertion pressure socket here to avoid problems with pins that might get bent under when inserting an EPROM. After soldering these three components in place it is important to recheck for shorts between data and address lines as board tracks run between pins. If, or when, all is well, proceed by inserting and soldering resistors R1 to R8 in place, followed by capacitors C1 and C2, switches SW1, SW2 and SW3. The switches are wired up with short lengths of tinned copper wire, direct to the pads on the board as shown in the underside wiring diagram.

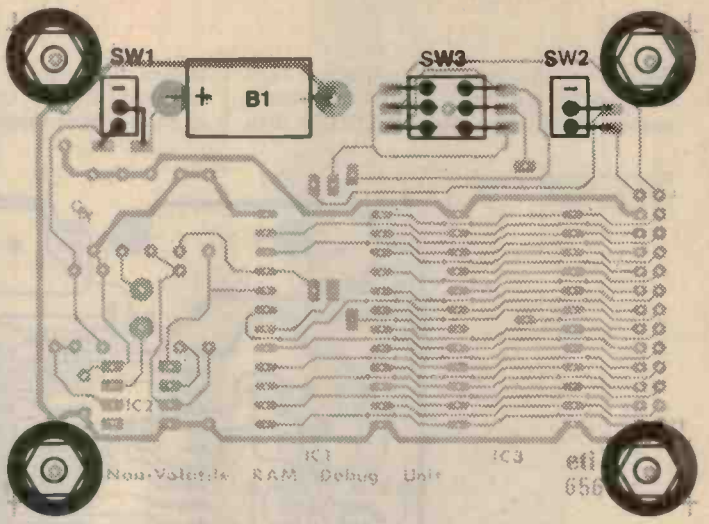
Next, insert the diodes, D1-D3, ensuring you get them all the right way round. Last of all, insert and solder IC2 in place, making sure that it, too, is correctly orientated.

If you're using battery backup, it is best to check the action of IC2 before proceeding to assemble it.

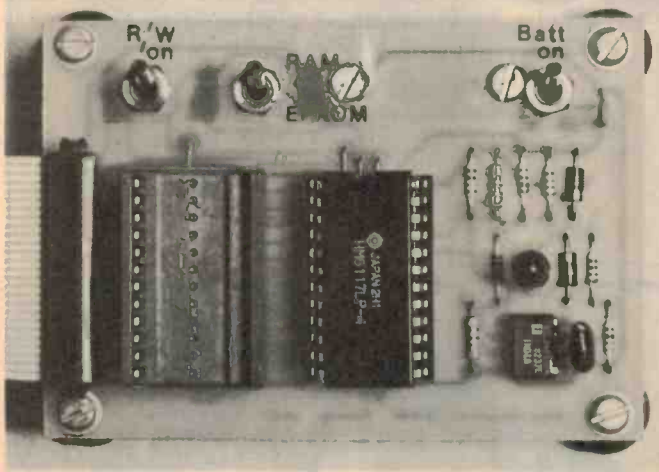
Connect a 5 V source between pins 24 and 12 of SK1 (EPROM socket). IC1 is not



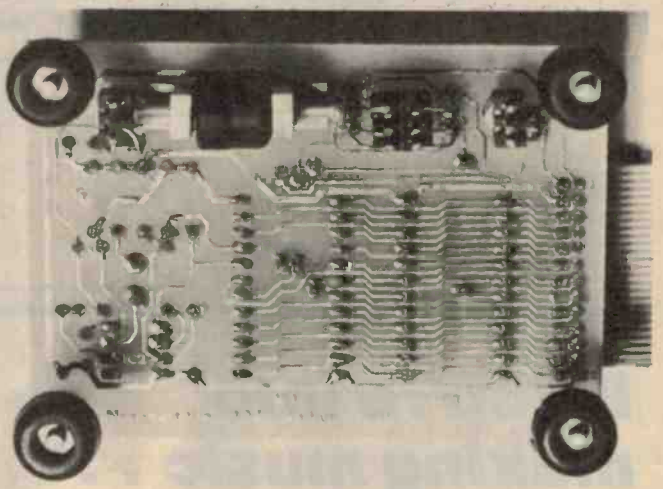
Topside overlay. Showing component placement. Put the links in first of all.



Bottomside overlay. Showing switch wiring and battery placement.



Topside view. Compare with the overlay above.



Bottom side view. Compare with the overlay above.

ETI-656 PARTS LIST

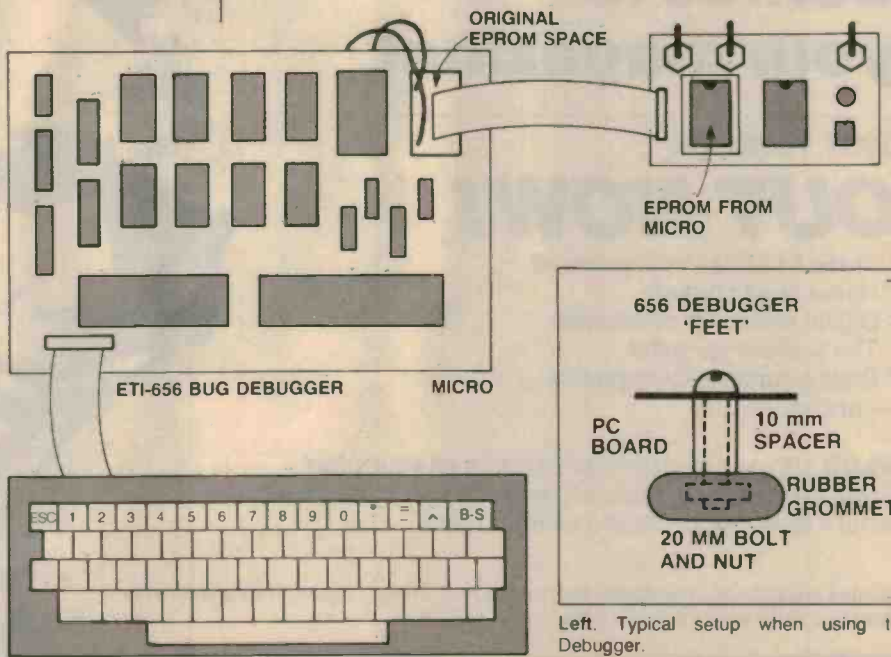
Resistors ..... all ¼W, 5%
- R1 ..... 220k
- R2 ..... 82k
- R3 ..... 820k
- R4 ..... 39k
- R5,R6 ..... 1M
- R7 ..... 47k
- R8 ..... 270R

Capacitors
- C1 ..... 47n greencap
- C2 ..... 100n bluechip ceramic

Semiconductors
- IC1 ..... HM6117LP-4
- IC2 ..... ICL7665
- D1,D2 ..... 1N4001
- D3 ..... TIL220R or similar

Miscellaneous

ETI-656 pc board; Scotchcal label; 1 x 24-pin low insert pressure socket (SK1) — Robinson-Nugent type TSN246; 1 x 24-pin IC skt; 26-pin header; 24-pin DIP adaptor plug & cover (R-N type MPB-246, MPC-246-1); 2 x SPST min. toggle switches; 1 x DPDT min. toggle switch; min. 3 V NiCad; 26-way ribbon cable; nuts, bolts, standoffs, grommets.



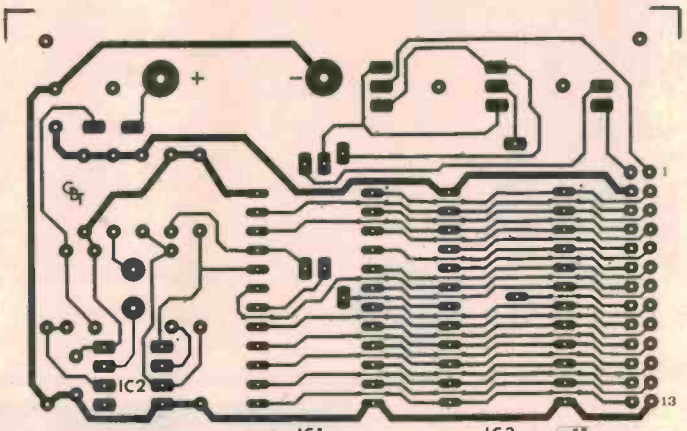
Left. Typical setup when using the Debugger. ▶

inserted for this test. Now, connect a variable supply, set to 5 V, across the battery pads on the board. Switch SW1 to ON, then reduce the output of the variable supply until the LED just comes on. Measurement of the variable supply should yield a value of approximately 2.6 V. Change the two supplies around so that the fixed 5 V supply is connected in place of the variable supply, at the battery pads. Connect a meter between pin 20 and pin 12 (0 V) of IC1. The reading should be very close to 5 - 0.7 = 4.3 V. Increase the variable supply from its previously set value of 2.6 V, towards 5 V. When the supply reaches about 4.0 V the meter reading should drop to nearly 0 V. Decrease the variable supply output to 3.78 V. Pin 20 of IC1 should have changed to about 4.3 V again.

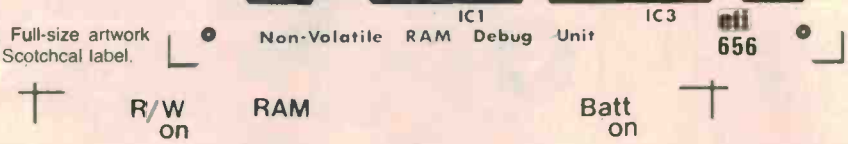
The power supplies can be removed, the battery switch set to OFF and the battery assembly attached to the board, *Observe battery polarity*. The particular assembly arrangments will depend on the physical arrangment of the battery you will be using, so exact construction details are not provided. IC1 can be inserted once the battery is in place. Now make up the cable assembly. A length of 26-way ribbon cable has a 26-pin IDC socket attached at one end. This plugs into J1 on the board. The other end goes to a solder DIP adaptor plug, as can be seen in the accompanying photograph. Flying leads for the CS2 and R/W lines are attached to pins 1 and 26, with small identifying labels stuck to them.

Go debug those bothersome bugs! ●

Right. Full-size artwork for the pc board.



Below. Full-size artwork for the Scotchcal label.



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This Month's Kits

ETI-656 THE BUG DEBUGGER

Ever burnt a program into EPROM and then found it wouldn't run? Without a logic analyser, it's difficult to debug the system. This project costs far less than a logic analyser and will get you out of that jam.

ETI-675 Microbee parallel-to-serial interface

When you're on a good thing ... Here's another Microbee project, but this one can be readily adapted to other machines, too.

ETI-273 LET CALLER

Play tennis anyone? This unit provides you with clear indication when a ball 'tips' the net in flight—requiring a LET call. Much more reliable than umpires and ball boys. Avoid disputes and tantrums (sorry Mac . . .). Cheap and simple to build.

$37.50 ETI Dec '83

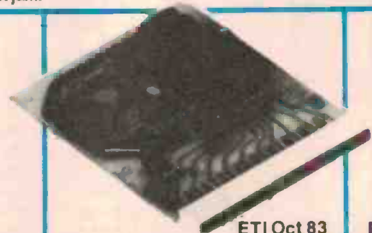
ETI 674 MICROBEE PROPORTIONAL JOYSTICK CONTROLLER

Oh the joy of a 'proper' joystick! Most computer joysticks are of the switch type. But, when you want to get into some 'real' joystick action, nothing beats a proportional joystick with potentiometers. This straightforward project for the Microbee, in our continuing popular series, simply plugs into the Bee's parallel port.

ETI-268 NICAD FLOAT CHARGER

$9.00 ETI MARCH '83

Keep your NiCad batteries in tip-top condition with this cheap, simple charger.



ETI Oct 83

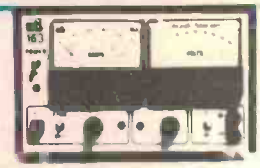
ETI-412 PEAK PROGRAMME METER

This project uses a 10-LED bargraph display module to show audio level from −23 dB to +6 dB. It's simple to build and set up.

ETI Oct 83 **$16.50**

ETI-672 MICROBEE TELETYPE INTERFACE

The "Claytons" of printers is the old surplus teletype—such as the Model 15 etc. For around a tenth the price of a dot-matrix printer, you can have hard copy from your microbee using this simple interface.



ETI MAY '83

ETI-163 LAB SUPPLY

$159

Fully variable 0–40 V current limited 0–5 A supply with both voltage and current metering (two ranges: 0–0.5 A/0–5 A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by a unique relay switching system switching between taps on the transformer secondary.

ETI-668 MICROBEE EPROM PROGRAMMER

$47.50 ETI FEB '83

Simple, low cost programmer for the MicroBee can program 2716s, 2732s and 2764s.

ETI-153 TEMP. PROBE

$19.95 ETI JUNE '83

Can measure temperature from −50°C to +150°C. It simply plugs into your multimeter—great for digital multimeters. Accuracy of 0.1°C, resolution of 0.1°C.

ETI MAY '83

ETI-323 HEADLIGHT DELAY UNIT

$17.50

Park your car and turn off the lights. Can't see where you're going? Press the button and the headlights come on to light your way, switching off automatically after 50 seconds. This is a simple, easy to build, low cost project.

$12.50 ETI Oct 83

ETI-671 MICROBEE PRINTER INTERFACE

A simple interface unit for parallel printers.

ETI-162 30 V/1 A FULLY PROTECTED POWER SUPPLY

ETI DEC '83 **$47.50**

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0 V to 30 V and selectable current limit. Both voltage and current metering is provided.

ETI-654 APPLE II ANALOGUE/DIGITAL INTERFACE

$159.00 ETI MARCH '83

This project will give your Apple a set of 8-bit digital inputs and outputs plus one analogue input and one analogue output. Applications include: driving a robot, recording science experiment results, etc. (digital only shown).

ETI-688 BIPOLAR PROM PROGRAMMER

$47.50 ETI JUNE '83

Every digital workshop should have one! Can be used to program the popular fusible-link PROMs like the 74S188/288, 82S23 and 82S123 etc.

ETI-461 GENERAL PURPOSE BALANCED INPUT PREAMP

$20.00 ETI Oct '82

This project can be used as a balanced mic amp. with low impedance input, a low or high impedance input differential amplifier or a balanced input instrumentation amplifier.

ETI Oct 83 **$475 inc. tax**

ETI-690 LITTLE BIG BOARD

Just what you've always wanted in a computer—a 'big' computer on a little board! This design runs a Z80A at 4 MHz, comes with 64K RAM, two RS232 ports and a floppy disk controller. It will run CP/M 2.2 and the board fits the soon-to-be-popular STD buss.

$29.50 ETI Dec '83

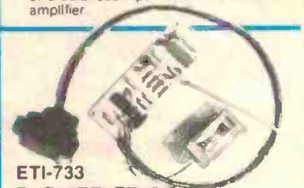
ETI—1518 VIDEO ENHANCER

This simple to build project features three controls for curing video 'image ills'—floor, ceiling and enhancement. It's designed to be installed either 'stand alone' or in with the ETI—1517 Video Distribution Amplifier.

ETI-335 PUSHBUTTON-PROGRAMMABLE WIPER CONTROLLER

$28.50 ETI MARCH '83

No more fiddling with knobs and not getting the delay between wipes that you want—this windscreen wiper controller is simply 'programmed' with two pushbuttons to provide the wiping delay you need.



ETI-733 RADIOTELETYPE CONVERTER FOR THE MICROBEE

$20.00 ETI APRIL '83

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your shortwave receiver's audio output and the MicroBee's parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too.

KITS — KITS — KITS

For tennis players — an electronic 'let' caller

This low cost, simple to build project detects when a ball 'tips' the net cord as it passes over — no more disputes about whether it did or it didn't! No false alarms either.

Geoff Nicholls

TENNIS IS a popular outdoor sport, particularly in summer. But a 'friendly' game can be spoilt by bad feelings arising from a dispute — particularly where a 'let' call is involved, where the ball is seen to 'tip' the net cord wire as it passes from one side of the court to the other. This little project will solve such disputes and is safe from 'human fallibility', provided it is correctly set up — a simple procedure.

When I first thought of this project, I realised some sort of sensor and detection system that was free from false alarms would be necessary. This ruled out using a microphone attached to the net cord. As net cords are (usually) steel, I hit upon the idea of using some sort of magnetic sensor. It was obvious that trying to slip a coil over the net cord was out of the question, so some other scheme had to be devised. Then again, winding coils is tedious, so a ready-wound coil of some description was necessary. Casting around for something suitable we discovered reed relay coils were cheap and readily available, so I did some experiments to see if one could be pressed into service. It worked!

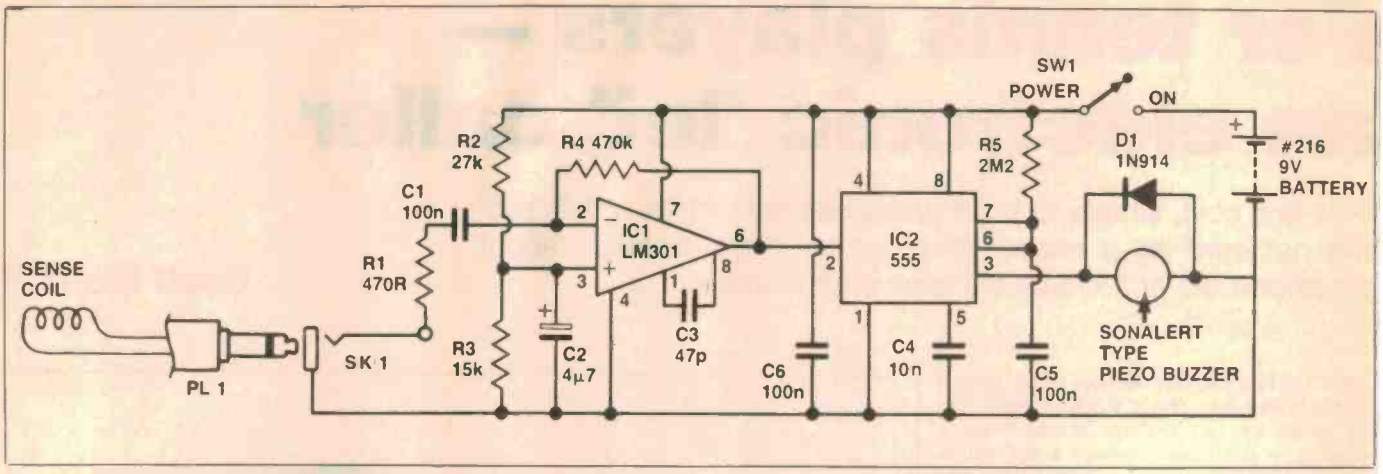
Thus, the sensor consists of, simply, a reed relay coil, a few brackets and a small bar magnet. This assembly is attached to the steel net cord, as shown in the accompanying diagram. When the ball strikes the net cord, a travelling wave moves out from the point struck by the ball, toward the net cord supports. The movement of the steel net cord in the magnetic field in the vicinity of the sensor coil causes a small variation in the magnetic field, inducing a voltage across the ends of the coil. This voltage pulse is detected and an alarm is sounded.

Construction

Everything except the sensor mounts in a small plastic box, the printed circuit board slots in to the grooves on the walls of the box with the 9 V battery on one side and space for the switch and sensor socket on the other side. The front panel is dressed up with a Scotchcal label.

The only unusual part of the project is the sensor, so I'll start with it. The heart of it is a reed relay coil, with a ⅛" (3 mm) steel screw down the middle clamping a small right angle steel bracket to each end. (See the accompanying photo). To create a good magnetic circuit I screwed two nuts up to

Neat and simple. All the bits for the Let Caller. There's not much to it, but it's certainly effective. The sensor coil is shown in the foreground. It mounts on the net cord (see diagram next page). ▶



the head end and put three nuts on the other end.

The sensor connects to the main unit via a 500 mm length of shielded cable, with a 70 mm length of 4 mm dia. heat-shrink tubing over the join. Secure the cable to the coil body with tape to relieve stress on the wires. Complete the sensor by soldering a 3.5 mm plug to the other end of the cable.

The Scotchcal label can be attached to the box lid now, the corner markers should be a few mm outside the lid area, so that they won't show when the label is trimmed. To get a good finish with a white background label I usually spray the lid with flat white paint and let it dry before sticking the label down. Once the label touches the lid it sticks fast, so it is important to carefully align it beforehand. Rub any trapped air pockets toward the edges and drill the holes for the switch and socket, then trim the four corner holes and lid edges with a sharp knife.

The piezo buzzer mounts on the plastic bottom of the box; the one I used required two holes in the box to pass the wires to its connecting pins. The buzzer easily attaches with double-sided adhesive tape.

Check that the pc board slots onto the box, trim by filing if necessary.

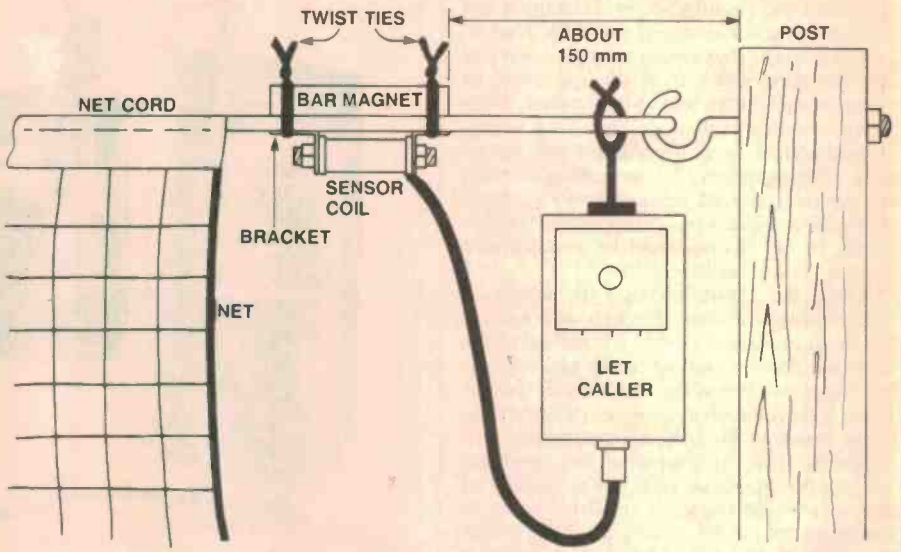
The pc board can be assembled now. The only point to watch is the orientation of the two ICs and the tantalum capacitor.

Solder a twisted pair of hookup wire between the pc board and the 3.5 mm socket, with 0 V going to the shield side. Complete the wiring to the battery and switch, then check that everything goes together. If the lid won't fit it is probably due to wires passing over the pc board. There are two solutions to this; either solder the offending wires to the copper side of the pc board or file an angle at the corner of the board for the wires to fit in.

The last thing to consider is how to attach the box and sensor to the tennis net. I used a plastic clip for the box called a Kurly-Lok On Base. Richco part no. KLB-750A. It is 40 mm high, has an adhesive base about 12 x 25 mm and is made by Richco, distributed here by Mayer Krieg & Co. You may be able to find another method of mounting but I bet it won't be as good as this curly clip which fits perfectly over the threaded rod used to tension the net.

The sensor and magnet work best when clamped onto the bare steel net wire about 150 mm from the post, with the wire between the two. I used wire ties as supplied with loaves of bread, although a clothes peg may be adapted to make it easier to attach.

The sensitivity is directly related to the strength of the magnetic field at the sensor coil. A small bar magnet is adequate, an old speaker magnet is superlative! (but probably 'overkill').



Installation. It's simple. Tie the sensor coil and magnet on the net cord about 150 mm from the post and hang the box near the post.

HOW IT WORKS — ETI-273

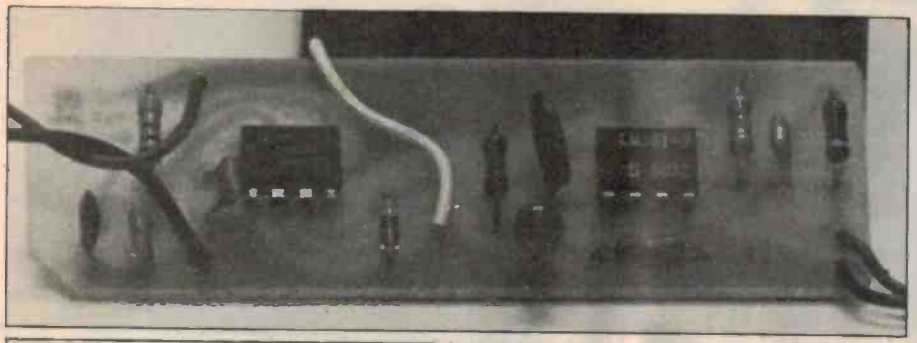
The sense coil is magnetically coupled to the net cord steel wire so that any change in the flux through the coil causes an induced voltage to appear across thd coil.

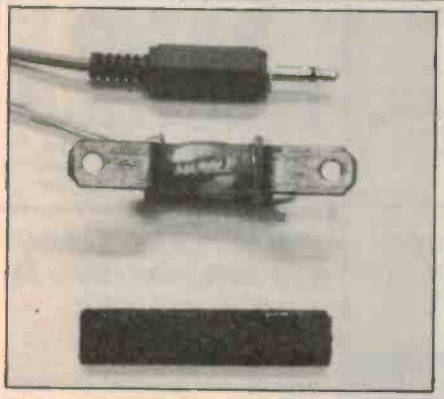
If the net wire is struck by the tennis ball the vibrations set up modulate the flux through the coil, thus producing an alternating voltage. This is amplified by IC1, an ac inverting amplifier designed with a gain of about 500 at 1 kHz, and a roll off of −20 dB per decade each side of that frequency.

Resistors R2 and R3 bias the amplifier's output to just over one-third of the supply voltage, C3 filters that bias voltage. IC2 is a 555 timer configured as a monostable multivibrator or one-shot with an interval of a quarter of a second.

When the voltage at the trigger input (pin 2) is less than one-third of the supply voltage, a timing interval is initiated, which sounds the piezoelectric buzzer. So any slight disturbance in the flux in the sense coil will cause the voltage at pin 2 of IC2 to drop below one third of the supply and activate the buzzer.

Diode D1 clamps any reverse voltage spikes from the buzzer, preventing false triggering.





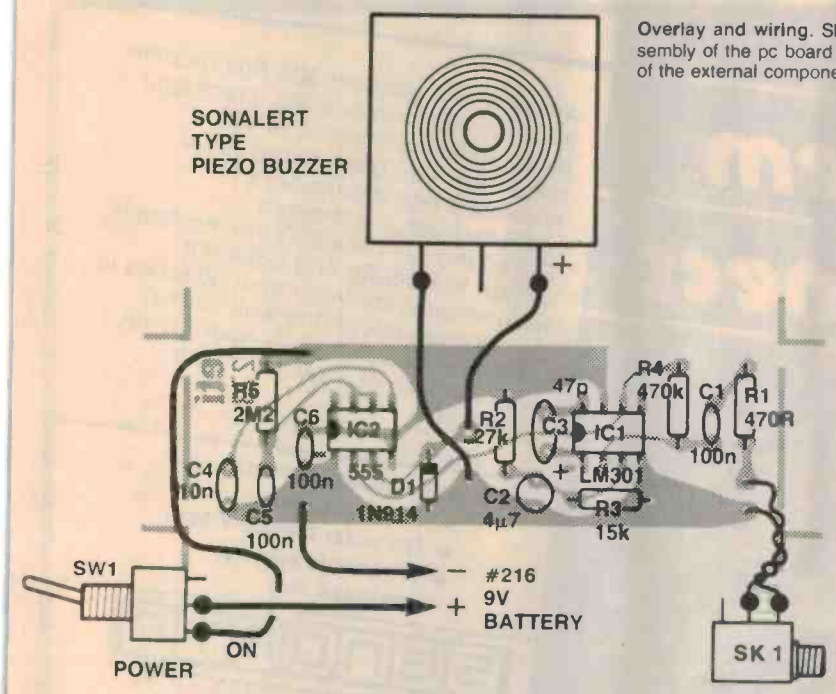
The bits. Above is a view of the completed pc board, below is a view of the completed sensor coil assembly.

Using it

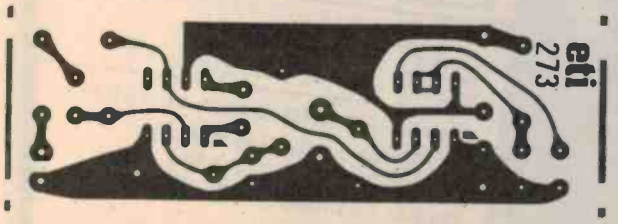
The Let Caller will beep once on power up, and may beep continuously if the sensor is not plugged in.

Since it responds to high frequency vibrations, a very slow serve may not 'twang' the net cord enough to trigger the unit, although I have used it for several hours and it never missed one. The wind doesn't seem to affect it either, and balls hit into the bottom of the net won't always trigger it. This confirms the validity of the sensor design and its superiority to a microphone-based system.

Having dispensed with the umpire, have a happy tennis game! ●



Overlay and wiring. Showing assembly of the pc board and wiring of the external components.



Board and panel. The pc board artwork is at left, panel artwork on the right. Both are shown full-size.

OTHER USES

The pc board could be used for a number of other purposes besides a Let Caller. For instance, the sense coil may be replaced by most transducers, as long as R4 was adjusted to suit the particular unit. The pulse length from IC2 can be increased by replacing C5 with a higher value tantalum capacitor. You could experiment and come up with a motor-bike alarm etc. The 555 IC can easily drive relays, so a high power load could be switched. The power supply can be anything up to 15 Vdc, so experimenters, go to it!

PARTS LIST — ETI-273

Resistors ..... all ¼W, 5%
- R1 ..... 470R
- R2 ..... 27k
- R3 ..... 15k
- R4 ..... 470k
- R5 ..... 2M2

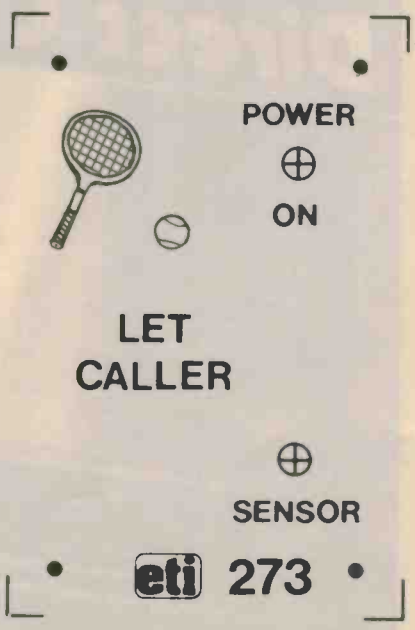
Capacitors
- C1, C5, C6 ..... 100n ceramic
- C2 ..... 4µ7/35 V tant.
- C3 ..... 47p disc ceramic
- C4 ..... 10n ceramic or greencap

Semiconductors
- IC1 ..... µA301, LM301, µA308, LM308
- IC2 ..... 555 timer

Miscellaneous

ETI-273 pc board; Scotchcal front panel label; plastic 'zippy' box 80 x 50 x 30 mm; piezoelectric buzzer — Sonalert, Murata or similar; reedy relay coil — D.S.E. cat. no. S-1948 or similar; 3.5 mm plug and socket (optional); 500 mm shielded cable; type 216 9 V battery and snap connector; single-pole single-throw (SPST) miniature toggle switch;m two right angle steel brackets 12 x 12 mm; ⅛" x 2" Whitworth (3 mm x 50 mm) steel bolt and five nuts; curly-clip — Richco KLB750A or similar; 50 mm long bar magnet; double-sided stick tape; hookup wire etc.

Price estimate: $20-$24



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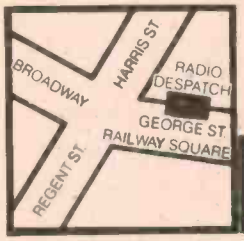

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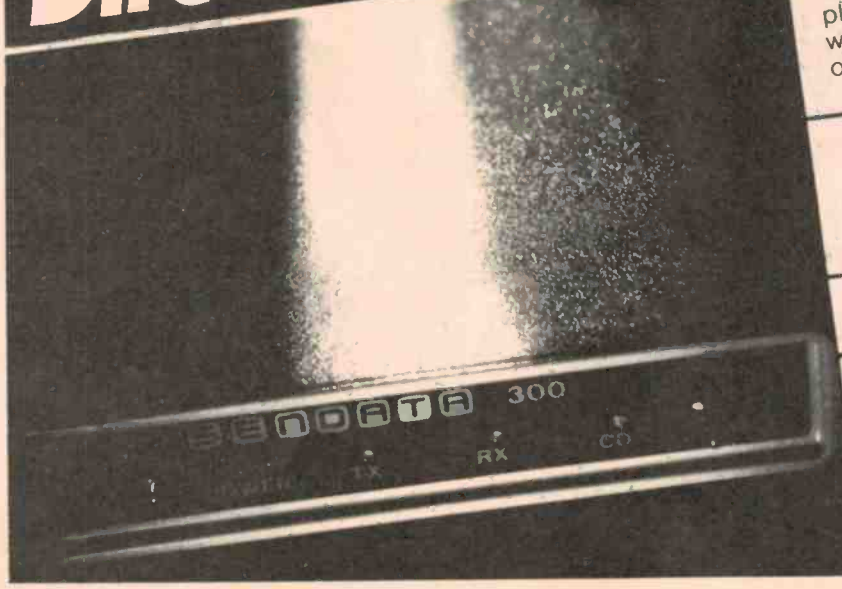
Sendata 300 Modem Direct Connect



A new direct connect 300 bps modem that is no taller than a 50c piece and fits snugly under the base of a telephone, has been released by Australian communications manufacturer, Electromed. Called the Sendata 300 the modem is simple to operate and does not require operator training. It attaches to the existing telephone wall socket plug and becomes fully operational with the flick of a switch by the operator.

- No installation costs.
- Simple operation.
- Fits under telephone base.
- Attaches to existing telephone plug.

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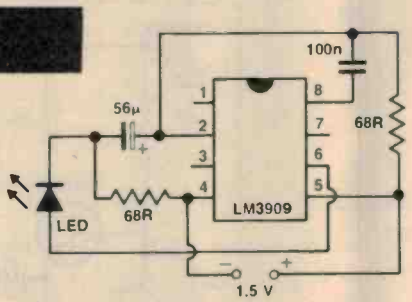
Circuit source guide '84

Here is a collection of circuits selected from the voluminous files of your Editor, Roger Harrison and some other sources. From this anthology you should be able to derive other circuits or assemble a system from a variety of 'blocks' to suit a particular application or solve a circuit problem. Applications covered range from audio to RF, timing to dc control, measurement to musical, etc. You may have seen some of these ideas before, but there are bound to be plenty you haven't.

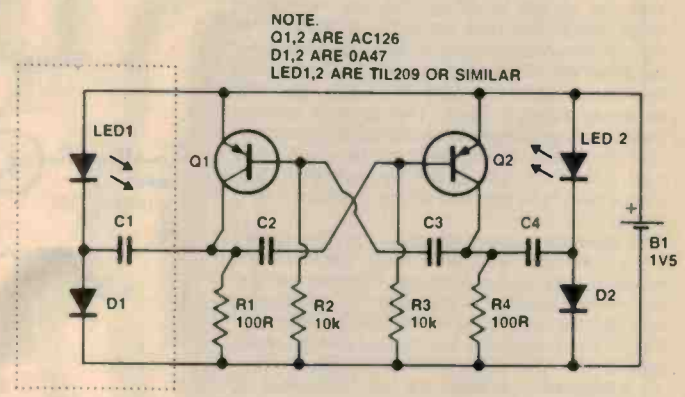
This feature is intended for the experienced experimenter, and construction details are not given. While the circuits have been checked for accuracy and feasibility, they have not necessarily been built and tested. We are unable to answer queries on individual modifications or construction techniques.

OPTO



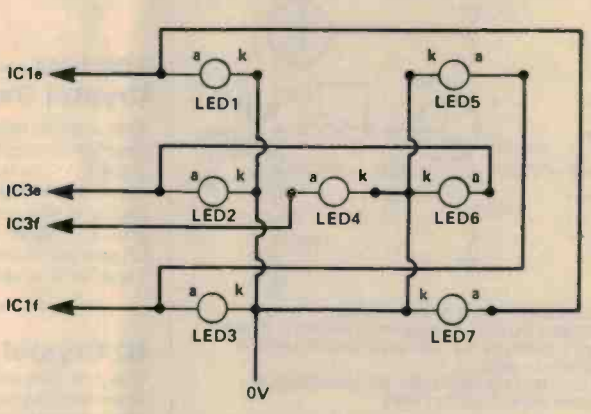
LED Light Booster

The LM3909 LED flasher IC is well known. It can be used to boost the brightness of ordinary LEDs by providing them with high current pulses at around 20 kHz — too fast for the eye to see flashing — giving an impression of increased brightness.



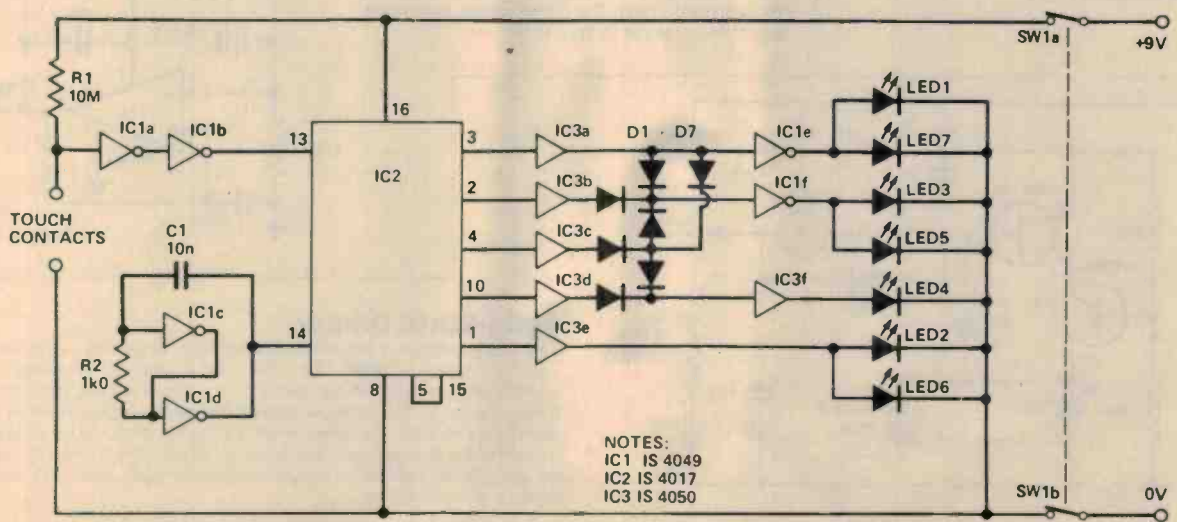
LEDs on 1.5 V Battery

As most LEDs require a forward voltage between 1.6 and 2.3 volts, it's difficult to power them from a 1.5 V battery. This circuit is an astable multivibrator and voltage doubler that boosts the voltage across the LEDs. To make the LEDs appear to be on continuously, C1 and C2 should be 47n, C3-C4 10µ. To make the LEDs flash alternately, C1-C2 should be about 100µ, C3-C4 should be about 10 times that. To operate a single LED, omit LED1, D1 and C1.



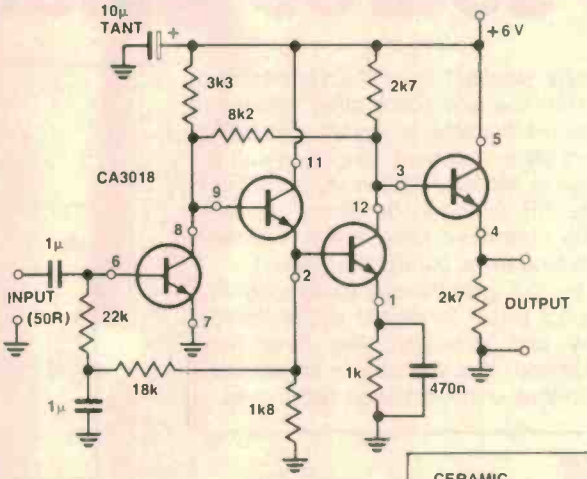
Die/dice Roller

A dice is more than one die — a six-sided solid with faces numbered 1 to 6 (i.e: a cube with numbered faces — you've all seen at least one). This is the electronic version. It comprises an oscillator and a counter with a 1 to 6 display output to LEDs. The LEDs can be arranged in the traditional die face, as shown.



Wideband Amp with dc Feedback

For high, stable gain, a wideband amp requires several stages with multiple dc feedback paths. The two left hand and two right hand transistors here form common emitter/common collector pairs, the common collector devices providing a high impedance load for the previous transistor and a low source impedance for the following stage. This reduces internal capacitive feedback. A CA3018 transistor array IC is used. The lower cutoff is determined by the capacitor values. Use low self-inductance metallised poly low voltage types.

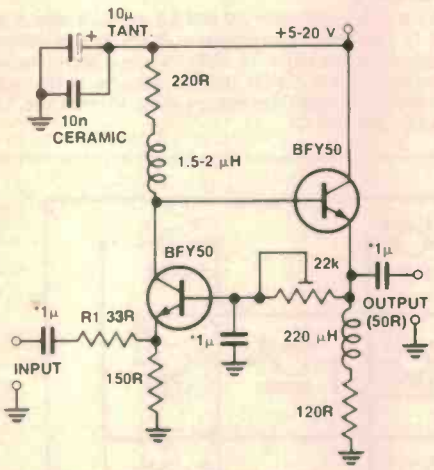


MIDBAND GAIN APPROX 50 dB
BANDWIDTH (−3 dB) 1 kHz-30 MHz.
MAX INPUT APPROX. 4 mV RMS

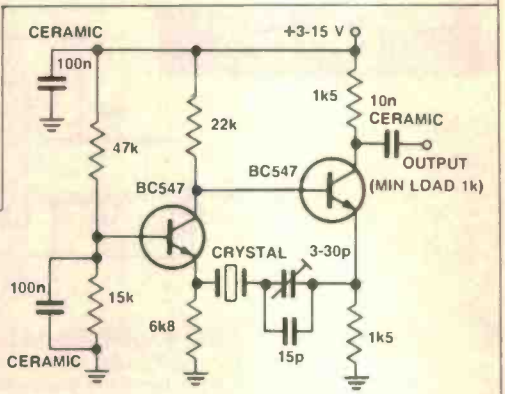
Wideband Power Amplifier

Well, not all that much power — in the milliwatt range, really. This uses the same configuration as the common-base/common-collector amp opposite, but power gain is provided and the circuit will deliver between about 10 and 180 mW output, depending on power supply voltage. The common collector stage provides current gain, transferring power to the load. This stage has to operate at a fairly high quiescent current. In fact, to get the bandwidth, both stages have to be operated at high quiescent current levels.

mon base stage compensates for the input capacitance of the common collector stage. The RFC in the emitter of the output device gives 'lift' at high requencies, helping broaden the bandwidth. R1 can be used to match the input to the source driving impedance. Two of these amplifiers can be cascaded to deliver around half a watt output with little decrease in overall bandwidth. Increase the 1µ capacitors to decrease lower cutoff.



MIDBAND POWER GAIN 13-15 dB.
POWER OUTPUT (5 V SUPPLY) APPROX. 10 mW (20 V SUPPLY) 180 mW; BANDWIDTH APPROX. 50 kHz-15 MHz.
* 50 V METALLISED POLY OR MONOBLOCK (LOW INDUCTANCE) TYPES.

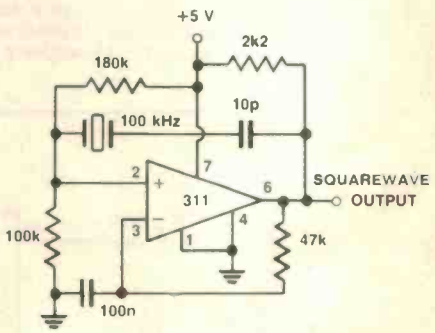


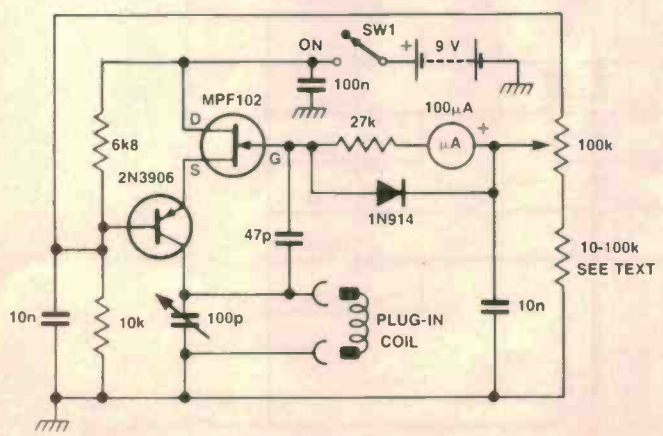
100 kHz — 10 MHz Crystal Oscillator

This untuned crystal oscillator will operate reliably over the range from 100 kHz to 10 MHz. Output level depends on supply rail, generally around one-third (peak-to-peak). Output is basically sinewave, but you can 'square up' the output by decreasing the value of the emitter resistor of the output transistor. Dropping it to, say, 220 Ohms gives good harmonics beyond 30 MHz from a 100 kHz crystal. While BC547 transistors are recommended, many types can be used, providing their gain-bandwidth product is 250 MHz or above. e.g: 2N5777, 2N3563/4, 2N3642, 2N2222, BF115, BFY90 etc. For crystals below 100 kHz, transistors with good LF gain are recommended — such as the 2N3565. Supply voltage can range from 3 V to 15 V. The trimmer capacitor is to set the crystal on frequency if necessary. If not, use a 100p ceramic.

IC Crystal Oscillator

This low frequency crystal oscillator provides an essentially squarewave output. Upper frequency limit is below 10 MHz. The output voltage swings virtually from rail to rail (5 Vp-p here).



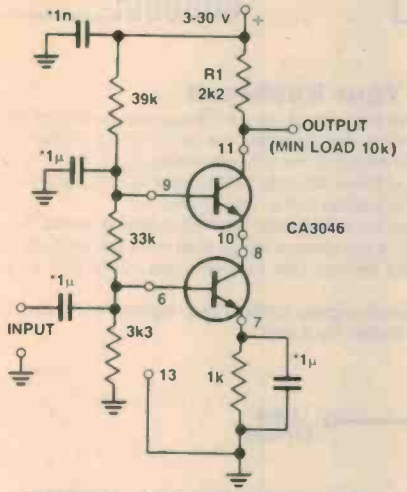


Solid-State Dipper

This circuit employs a grounded-base oscillator to provide tuning via a single-gang variable capacitor where the rotor plates can be grounded. Simple two-terminal plug-in coils can be used too. The circuit will oscillate over quite a wide frequency range. the 100k pot adjusts the oscillation amplitude to suit the meter and battery voltage. The series resistor to common should be adjusted to cut-and-try so that the pot operates over its range. At upper VHF, the 47p capacitor should be reduced. All capacitors should be ceramic types and short leads are recommended in construction.

Wideband Cascade Amplifier

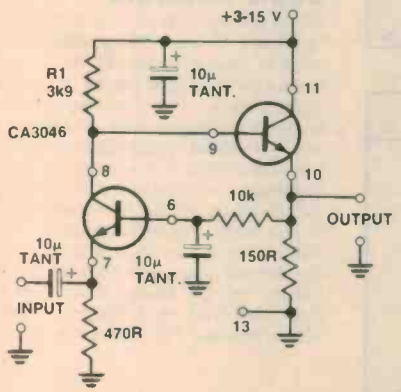
The major feature of the cascade amplifier configuration is the isolation between input and output. This makes for very good stability regardless of the load reactance. The 'lower' transistor is connected as a common emitter amplifier, the 'upper' one operating in grounded base. This circuit employs two transistors as a common substrate from a transistor array IC (CA3046), each having h_{FE} of 110 and f_T of 450 MHz. Upper cutoff determined is by R1. Increase all capacitor values to reduce lower cutoffs. A CA3018 may be used or discrete transistors such as 2N706, 2N2369, 2N3607, MPS3646 or 2N5769.



MIDBAND GAIN (LOADED) APPROX. 32 dB.
BANDWIDTH (−3 dB) APPROX. 5 kHz-4 MHz.
ALWAYS GROUND PIN 13 OF CA3046
* 50 V METALLISED POLY TYPES
OR TAG TANTALUMS (WATCH POLARITY)

Common Base/Common Collector Wideband Amp

This amplifier configuration has the advantage of low input and low output impedances — around 100 Ohms here. Two devices from a transistor array IC are used. Use dipped tantalum capacitors and keep leads short for best results. You can match the input impedance to the impedance of the source by varying R1, which varies the emitter current of the common base stage and hence the input impedance. Linearity of this configuration is very good, but gain is not high.



MIDBAND GAIN APPROX. 17 dB.
BANDWIDTH (−3 dB) APPROX. 150 Hz −3.5 MHz.
MAX. INPUT AT 5 V SUPPLY APPROX. 40 mV RMS
ALWAYS GROUND PIN 13 OF CA3046

TYPICAL PERFORMANCE CURVES
(MHW710-2)

FIGURE 1 – INPUT POWER, EFFICIENCY AND VSWR versus FREQUENCY

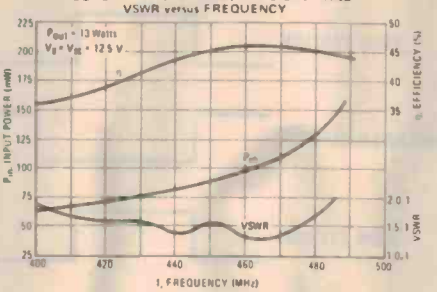


FIGURE 2 – OUTPUT POWER versus INPUT POWER

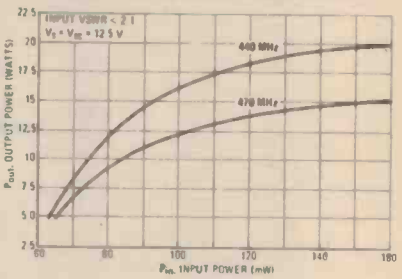


FIGURE 3 – OUTPUT POWER versus VOLTAGE

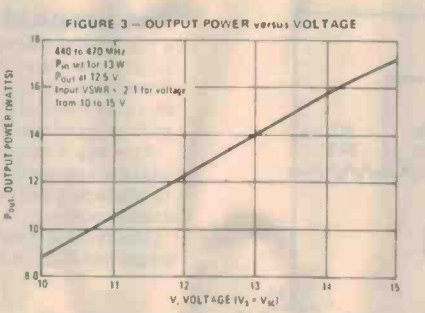
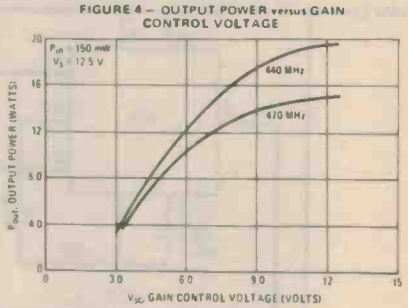


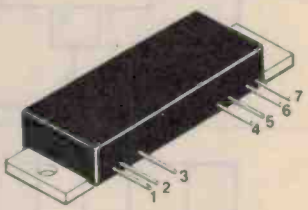
FIGURE 4 – OUTPUT POWER versus GAIN CONTROL VOLTAGE



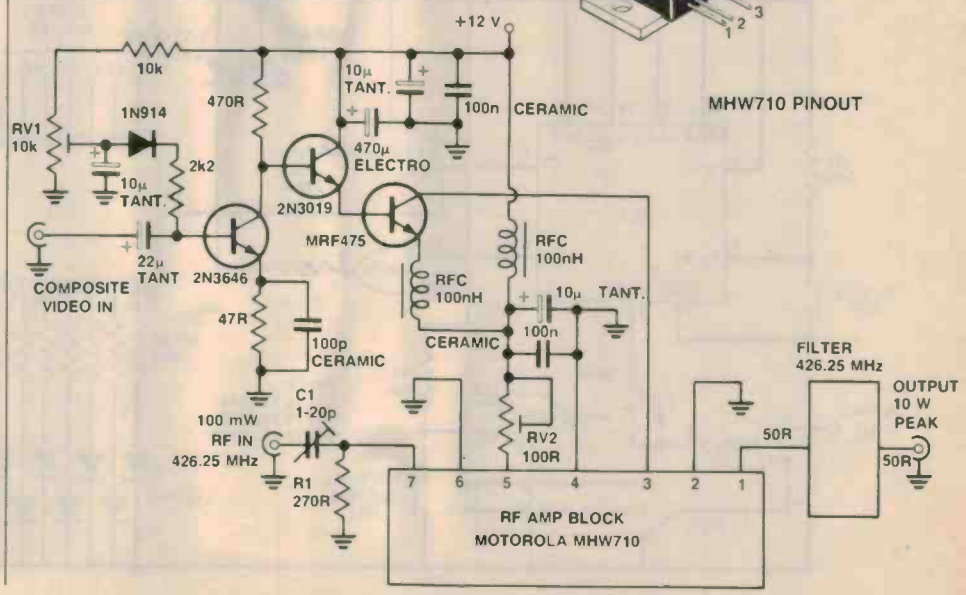
Amateur TV Modulator/Output Stage

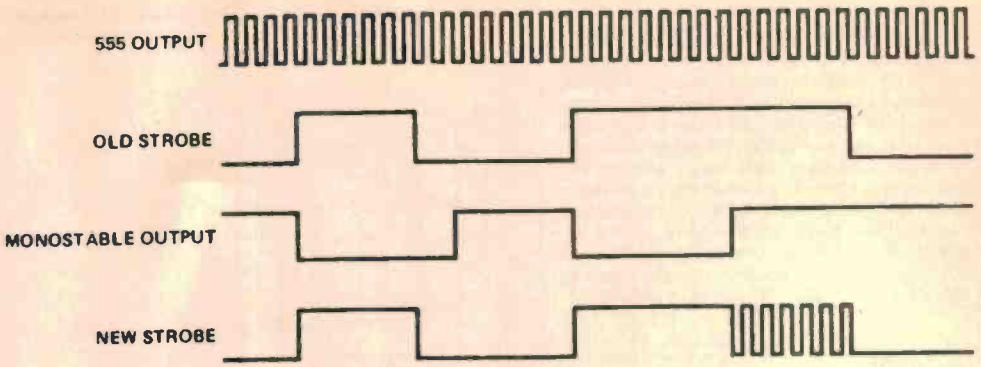
According to Les Jenkins VK3ZBJ, high level modulation for amateur TV applications has distinct advantages over low level modulation followed by a string of linear amplifiers. The main problem with the latter approach is getting the linearity, particularly with solidstate stages. This circuit (from Les) does the job, only requiring about 100 mW of RF drive at 426.25 MHz and standard level composite video input from the camera. Peak RF output is 10 watts which will put quite a respectable signal on the air.

The Motorola MHW710 UHF 'gain block' is readily available and comparitively cheap. Good UHF construction practices should be used. The MHW710 is made for stripline termination to the pins. It should be bolted directly to a heatsink with double-sided pc board (glass fibre or teflon-glass) butted beneath the pins with appropriate tracks to provide termination. C1 and R1 should have virtually no leads. The output filter need not be anything fancy, a stripline or coaxial bandpass type should do the job. Remember, you're dealing with video bandwidths, keep it broad.



MHW710 PINOUT



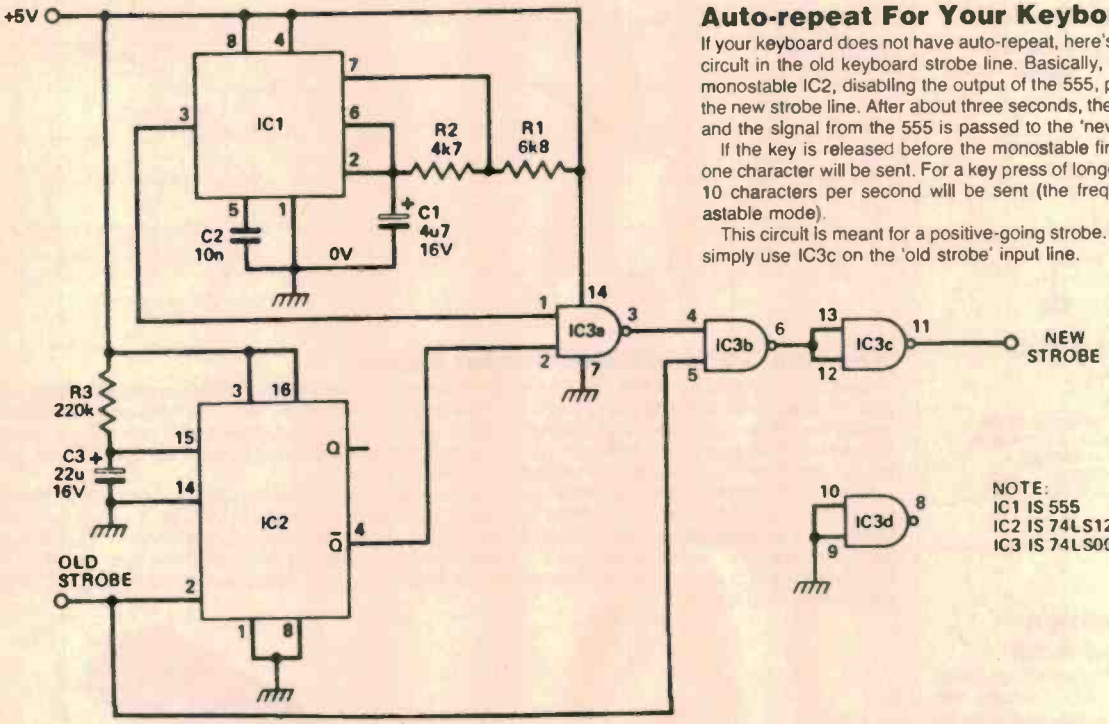


Auto-repeat For Your Keyboard

If your keyboard does not have auto-repeat, here's the solution. Just insert this circuit in the old keyboard strobe line. Basically, the strobe line activates the monostable IC2, disabling the output of the 555, preventing its pulses reading the new strobe line. After about three seconds, the output of IC2 changes state and the signal from the 555 is passed to the 'new strobe' line.

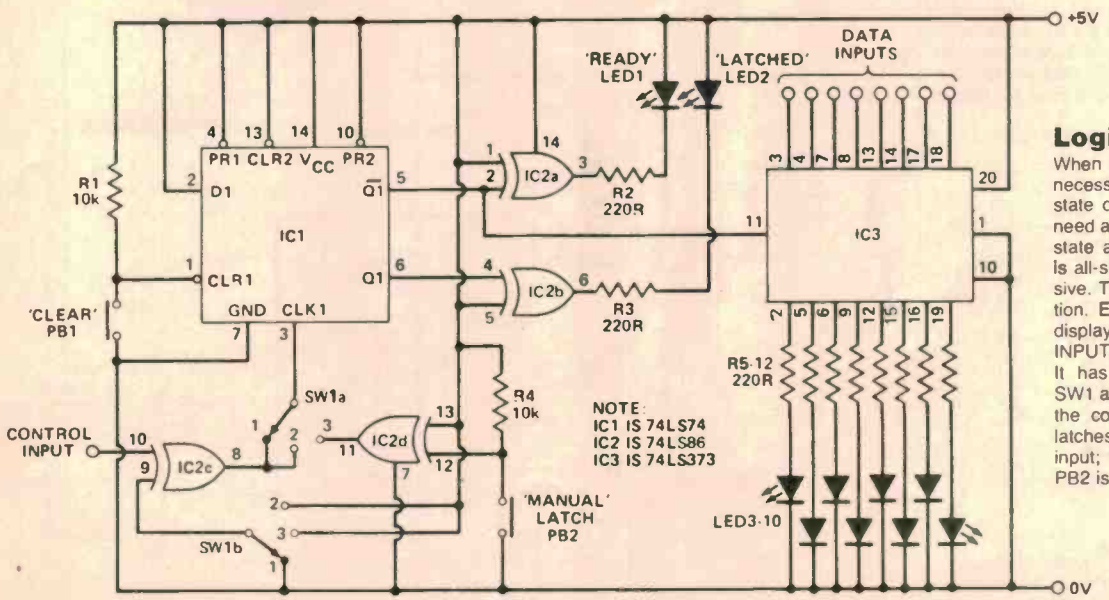
If the key is released before the monostable finished its timing period, only one character will be sent. For a key press of longer than three seconds, about 10 characters per second will be sent (the frequency set by the 555 in its astable mode).

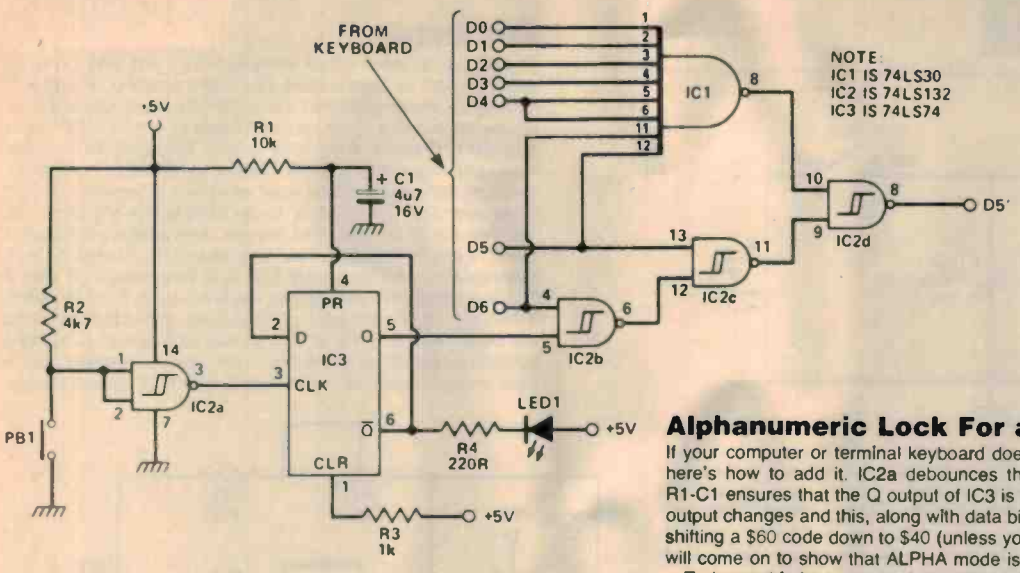
This circuit is meant for a positive-going strobe. For a negative-going strobe, simply use IC3c on the 'old strobe' input line.



Logic Analyser

When testing logic circuits it is often necessary to know the simultaneous state of several nodes. To do it, you need a bunch of logic probes or a logic state analyser. The 'professional' tool is all-singing-and-dancing, and expensive. This circuit is a simpler implentation. Eight input bits are latched and displayed, controlled by the CONTROL INPUT from the circuit being analysed. It has three triggering modes: with SW1 at 1, it latches on a rising edge on the control input; with SW1 on 2, it latches on the falling edge control input; with SW1 on 3 it latches when PB2 is pressed. PB1 clears the latch.





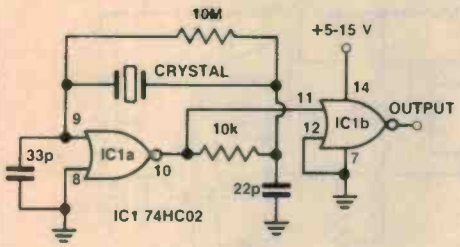
Alphanumeric Lock For a Keyboard

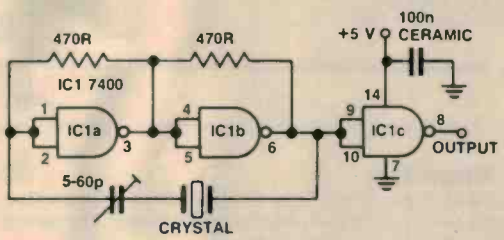
If your computer or terminal keyboard does not have an alphanumeric lock key, here's how to add it. IC2a debounces the alpha-lock key PB1. On power-up, R1-C1 ensures that the Q output of IC3 is high. Each time PB1 is pressed, the Q output changes and this, along with data bit 6 being high, will make D5 a low thus shifting a $60 code down to $40 (unless you pressed the DELETE key). The LED will come on to show that ALPHA mode is selected when PB1 is pressed.

To insert this into your keyboard it is only necessary for the original D5 line to pass through this circuit (D5 to D5') and add a keyswitch for PB1.

HCMOS Crystal Oscillator

This circuit works well with crystals in the MHz region, up to 15 MHz, perhaps more. It starts reliably and can be operated on any supply rail between 5 V and 15 V. The 22p and 33p capacitor values may need to be increased for lower frequency crystals — but maintain the ratio.





Reliable TTL Crystal Oscillator

Many TTL crystal oscillators have been published over the years, and many exhibit unreliable oscillation — particularly on startup. This one has none of those problems. This will work with crystals in the 1 MHz to 20 MHz range as well as with 'Ceralock' ceramic resonators. The trimmer is to set the crystal to frequency, if necessary. If not, substitute a 100p-1n ceramic capacitor.

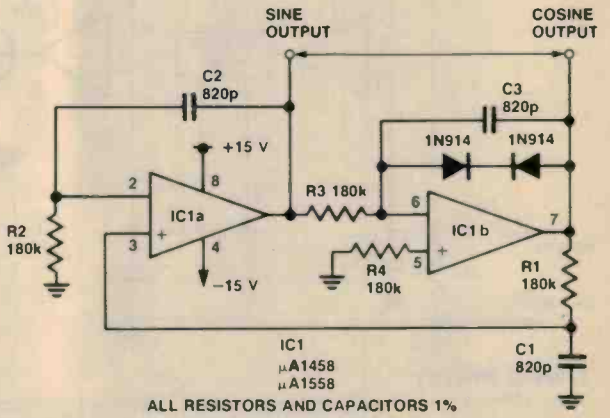
GENERATORS

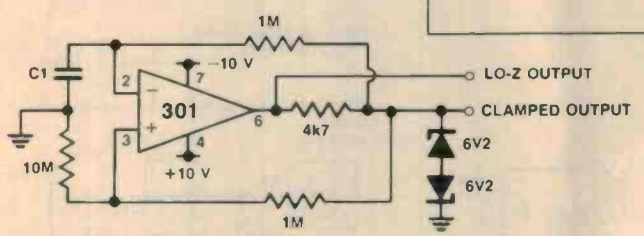
Quadrature Sinusoid Oscillator

This oscillator provides two sinusoid outputs precisely 90° apart. All capacitors should be 1% types. R1C1 = R2C2. The oscillation frequency is given by:

$$f = \frac{1}{2\pi\sqrt{C2R2C3R3}}$$

(R1C1 = R2C2)



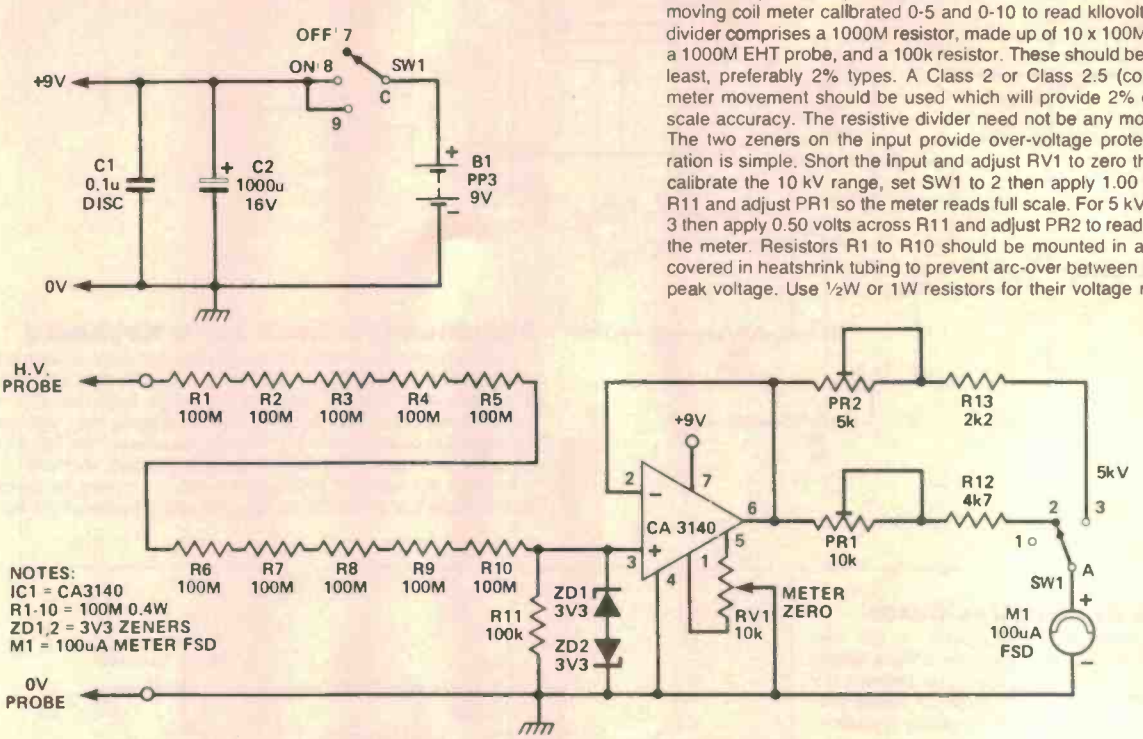


Low Frequency Squarewave Generator

The output frequency of this generator is determined by C1 and the 10M resistor. A low impedance output, that swings almost from rail to rail, can be taken from pin 6 of the 301, or a clamped output — limited by two 6.2 V zeners — gives a 6.8 V peak-to-peak output. Maximum supply voltage is ±18 V.

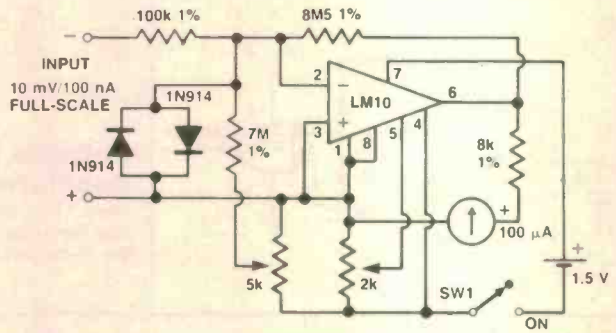
EHT Meter

This simple dc meter circuit will read 0-5 kV and 0-10 kV. A high impedance input op-amp is used as a meter amplifier, driving a 100 µA moving coil meter calibrated 0-5 and 0-10 to read kilovolts. The input divider comprises a 1000M resistor, made up of 10 x 100M resistors or a 1000M EHT probe, and a 100k resistor. These should be 5% types at least, preferably 2% types. A Class 2 or Class 2.5 (common type) meter movement should be used which will provide 2% or 2.5% full-scale accuracy. The resistive divider need not be any more accurate. The two zeners on the input provide over-voltage protection. Calibration is simple. Short the input and adjust RV1 to zero the meter. To calibrate the 10 kV range, set SW1 to 2 then apply 1.00 volts across R11 and adjust PR1 so the meter reads full scale. For 5 kV, set SW1 to 3 then apply 0.50 volts across R11 and adjust PR2 to read full scale on the meter. Resistors R1 to R10 should be mounted in a 'string' and covered in heatshrink tubing to prevent arc-over between their ends at peak voltage. Use ½W or 1W resistors for their voltage rating.

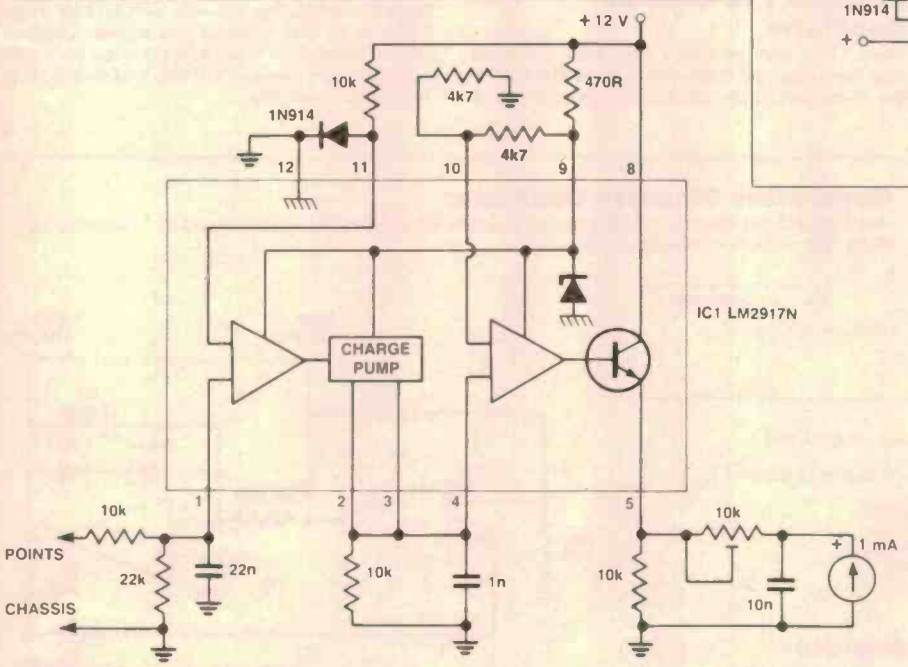


mV-nA Meter Amplifier

This meter amplifier can be calibrated to read either 10 mV or 100 nA full-scale. Zero set is provided by the 2k trimpot and full-scale calibration by the 5k trimpot. The back-to-back diodes on the input provide input overrange protection.



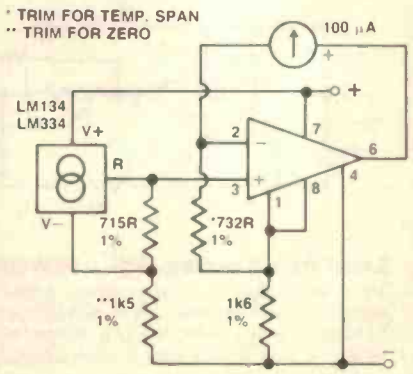
Dwell Meter

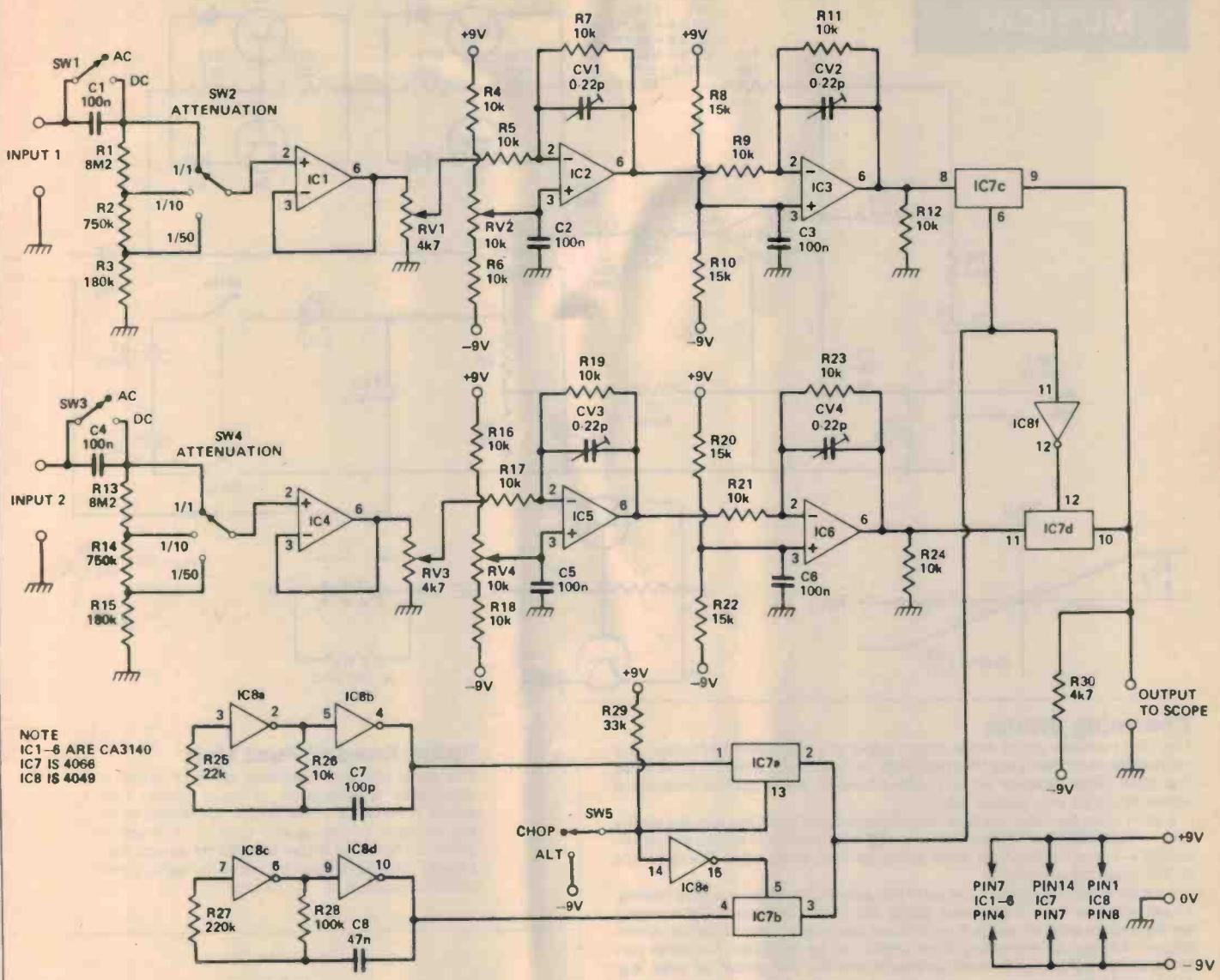


The LM2917 is a frequency-to-voltage converter, used here to measure the 'points closed' period or engine 'dwell'. Construction is non-critical. Calibration is by means of the 10k trimpot. Use a 50% duty cycle square wave of a few volts to calibrate the meter — 45° is half-scale for four cylinder engines.

0-100°C Thermometer

A precision temperature sensor, the LM134, provides an output of 10 mV/°K. The LM10 provides 'normal' temperature offset and amplification so that a moving coil meter movement can be used to indicate temperature.



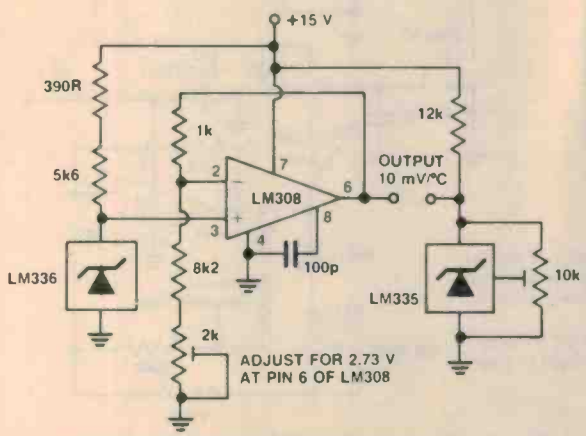


CRO Dual-Trace Switch

This permits a single-channel CRO to be turned into a dual-trace unit. Two modes of display are provided: 'chop' and 'alternate'. When examining frequencies between dc and about 15 kHz 'chop' mode is used as trace speed across the screen (timebase speed) is relatively slow. About 15 kHz, 'alternate' mode is used when the timebase makes separate sweeps of the screen for each trace.

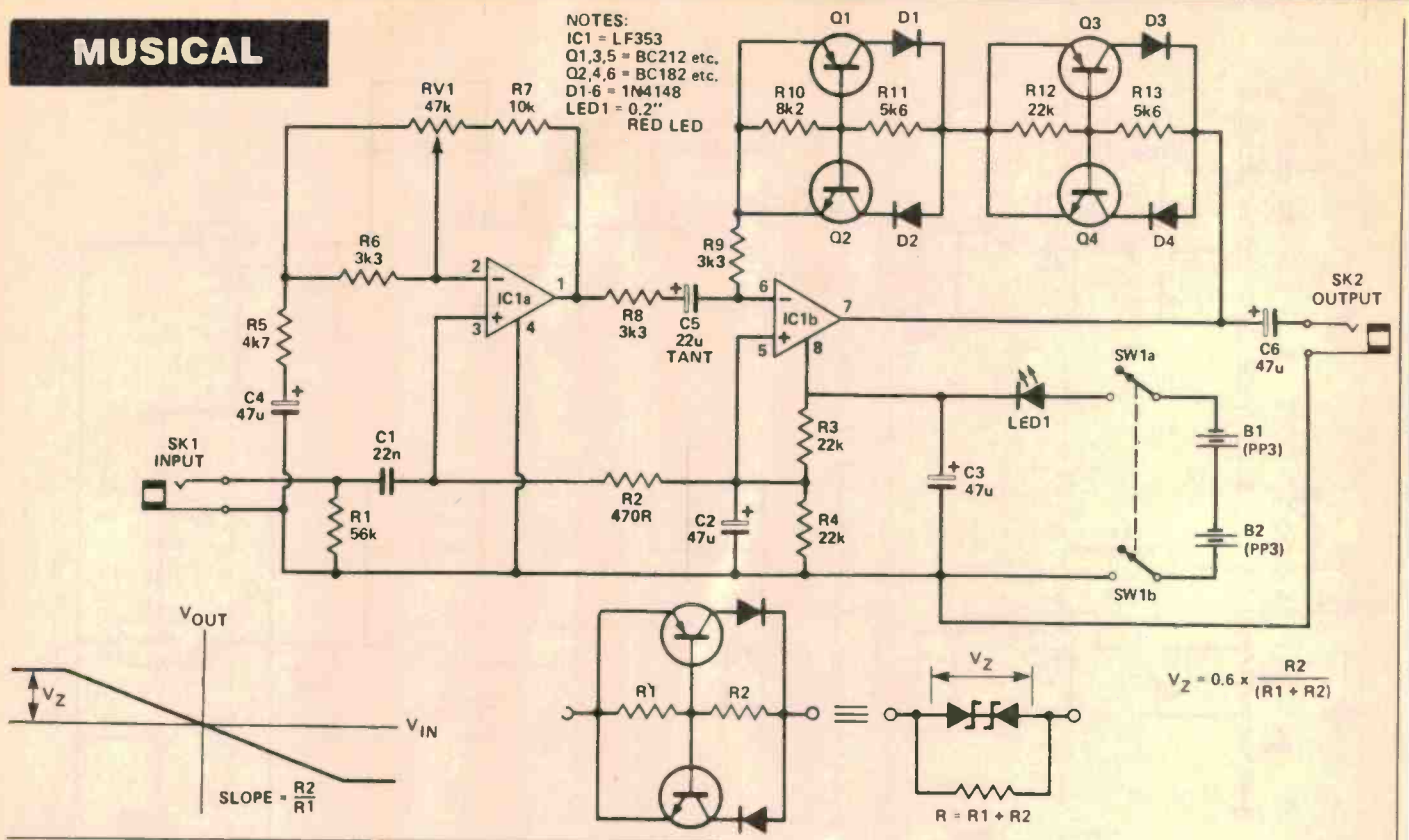
Two preamps are used, each having a bandwidth extending from dc to about 2000 kHz. The outputs of the channels are switched to the CRO input by an electronic changeover switch comprised of IC7c-d and IC8f, driven by an oscillator. Two oscillators are used, one for the chop mode, one for the alternate mode, as different switch speeds are necessary.

Setting CV1-CV4 is critical. Procedure is identical for both channels. Inject a 1 Vp-p 100 kHz squarewave into Input 1 and set SW2 to the 1/1 position. Setting of SW1 is unimportant. Set RV1 to maximum and RV2 to mid-position. Connect a CRO to the output of IC2 and adjust for the best squarewave response. (No overshoot and least rounding). Then move to IC3's output and adjust CV2 for best response. Repeat the procedure for the other channel.



Centigrade Thermometer

This simple circuit can be used to measure temperature in Centigrade degrees and will read out directly on a standard digital multimeter. The LM336 is a precision 2.5 V voltage regulator, the LM335 a precision temperature sensor. The LM308 output provides a 'stiff' reference scaled up from absolute zero. The 2k trimpot is set to provide 2.73 V between pin 6 of the 308 and common. The 10k trimpot is set so that you get 2.982 V across the LM335 at 25°C. The LM335 can be used for contact temperature measurement.

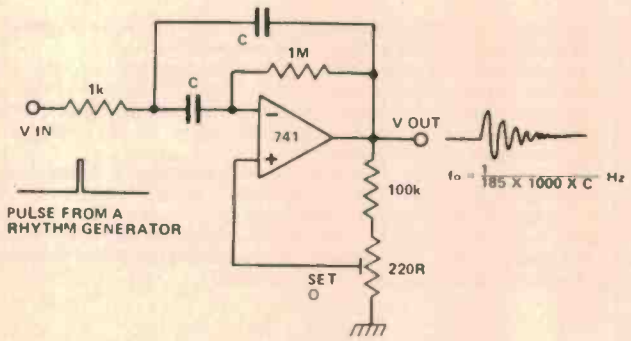


Charming Chime

This circuit enables you to add a 'chime' output to a percussion synthesiser. It is multiple feedback bandpass filter that 'rings' in response to a narrow pulse input. The 220R preset labelled 'set Q' provides variation of the positive feedback. It should be set for best 'ringing' results.

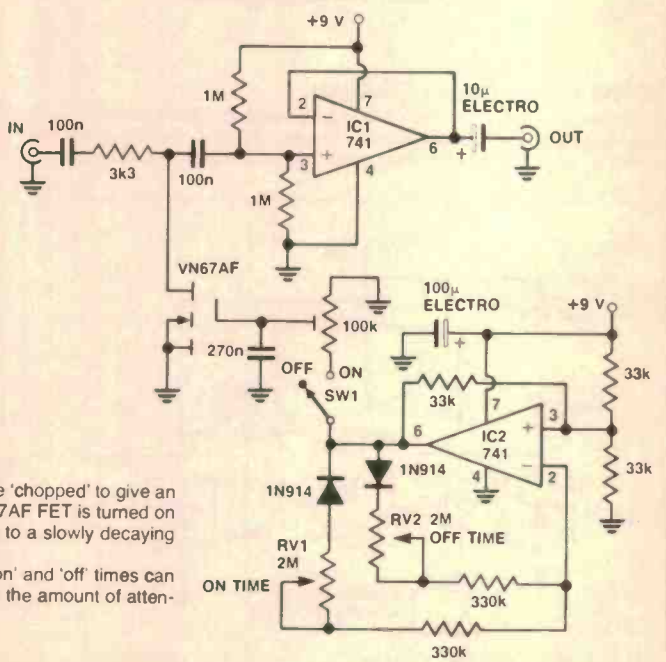
A short pulse applied to the input causes the circuit to break into damped oscillation — the amplitude of the oscillation peaking rapidly and then dying away exponentially — hence the ringing or chime sound, as if you struck a bell. The higher the Q, the longer the decay time.

If the oscillation frequency, f_o, is set in the upper audio range, you get a 'tinkling' sound, whereas lower frequencies sound like claves or bongos. By arranging several circuits with their inputs in parallel and their outputs mixed together, all with different tunings, an interesting chime chord can be produced. For better performance, an op-amp with wider bandwidth than the 741 should be used. e.g: TL071, 5534 etc.



"Blue Suede" Fuzz Unit

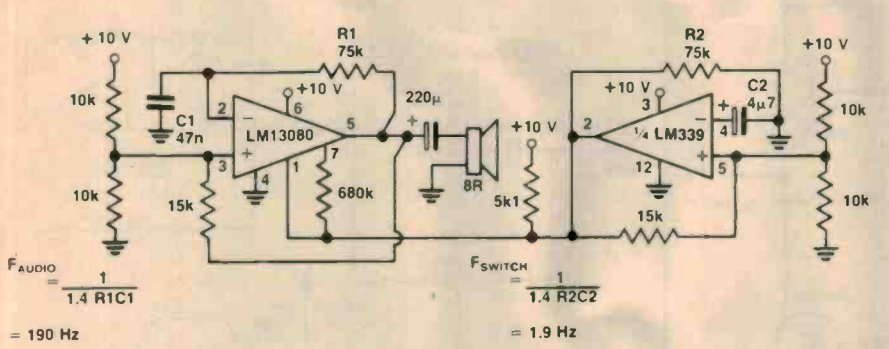
This guitar effects unit provides 'soft fuzz', giving a reasonable approximation to valve guitar amp sound. A series of 'active zeners' are employed in the feedback of the op-amp IC1b. A third active zener can be added to give an extra breakpoint. The existing breakpoints can be varied by varying the values of resistors 10, 11, 12 and 13.



Chopper Echo Effects Unit

Music signals which have a sharp attack/slow delay envelope, such as guitar etc, can be 'chopped' to give an effect not unlike an echo. Here, IC1 is just a unity gain non-inverting amplifier. The VN67AF FET is turned on and off to short the signal or pass the signal, respectively. If this is done at a slow rate to a slowly decaying note, an 'echo' effect is obtain.

IC2 and associated components form a low frequency pulse generator in which the 'on' and 'off' times can be independently set by RV1 (on time) and RV2 (off time). The 100k preset determines the amount of attenuation afforded by the VN67AF (effect 'depth').

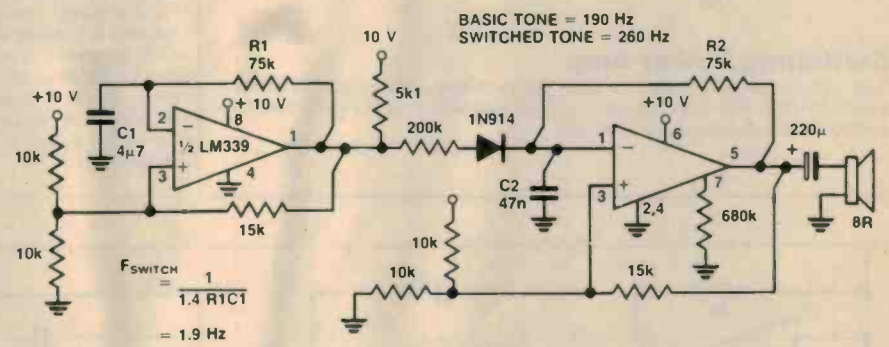


Two-state Siren

Here is a siren that keys a burst of 190 Hz tone on and off twice per second. The LM13080 power op-amp is arranged as an oscillator, keyed on and off by the LM339 arranged as a low frequency multivibrator. Note that a 12 V supply can be used.

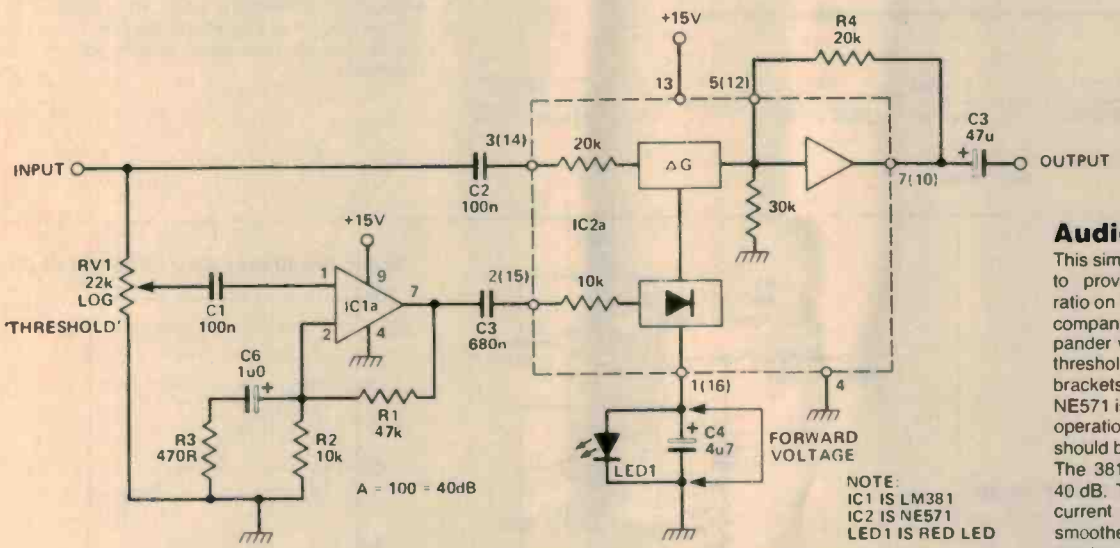
Two-tone Siren

In this siren circuit, the LM13080 power op-amp is arranged as an oscillator that is switched between two frequencies (190 Hz and 260 Hz). The LM339 is a low frequency multivibrator operating at around 2 Hz.

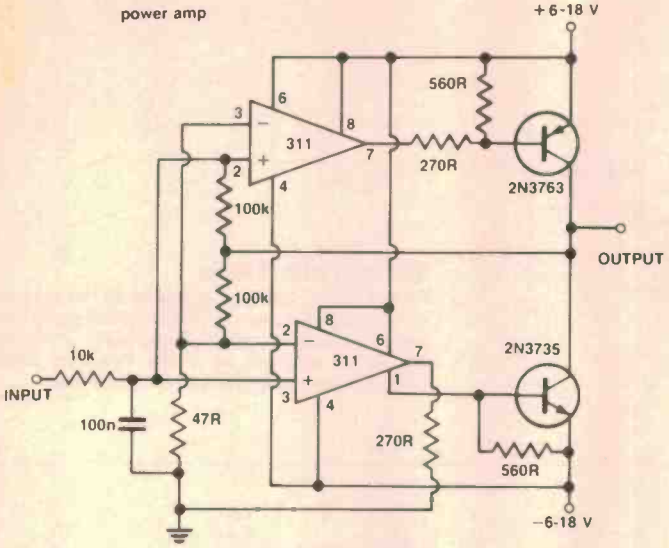


Audio Expander

This simple expander gate can be used to provide improved signal-to-noise ratio on records and tapes. The NE571 compander chip is used here as an expander with a red LED used to set the threshold at pin 1. Pin numbers in brackets are for the other 'half' — the NE571 is a dual compander. For stereo operation, the two threshold LEDs should be matched for forward voltage. The 381 amplifies the input signal by 40 dB. This is rectified by the internal current mirror of the NE571 and smoothed by C4. When the voltage reaches the forward voltage of the LED, it draws current and limits the current to the gain cell. This then provides linear operation above the threshold.

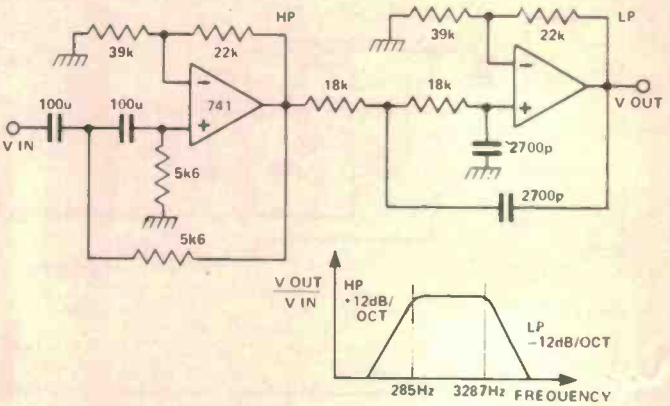


FOR STEREO USE, THE FORWARD VOLTAGE OF THE RED LEDs SHOULD BE MATCHED (ABOUT 1V5) (INJECT SIGNAL TO L+R UNTIL BOTH LEDs ARE LIT)



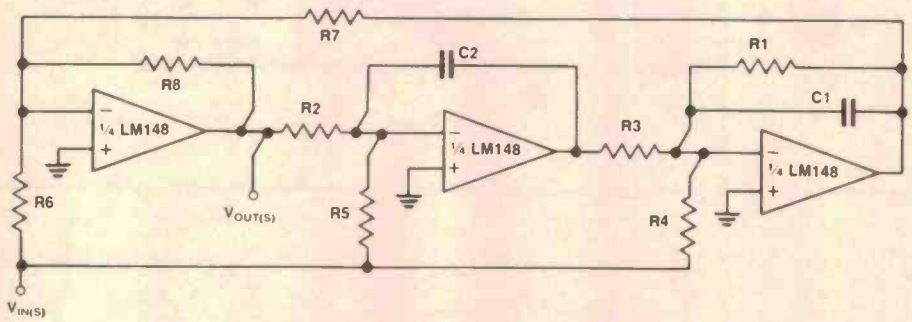
Switching Power Amp

Two 311 comparators used in a class B power amp. The output devices only switch on when alternate input cycles exceed a small voltage threshold. Feedback largely reduces the crossover distortion.



Speech Filter

For any purely speech audio system application — communications receivers, transceivers, dictaphones etc. — it is desirable, for best intelligibility, to limit the audio bandwidth to provide relatively steep rolloff below about 300 Hz and above about 3 kHz or so. Most speech information is contained between these limits. This circuit shows a simple bandpass filter sytem with 12 dB/ octave rolloff below 285 Hz and above 3287 Hz. One unusual application of such a filter would be in a 'light show' system so that the display varies with voice variations of an announcer or performer.

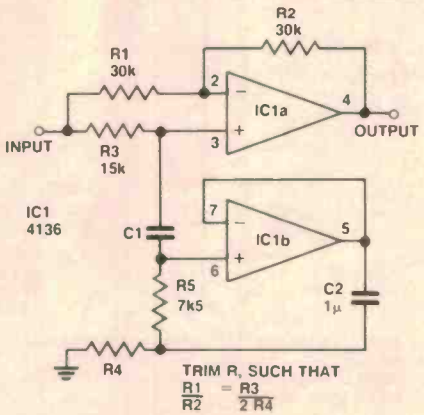


$$Q = \sqrt{\frac{R8}{R7}} \times \frac{R1C1}{\sqrt{R3C2R2C1}} \quad f_0 = \frac{1}{2\pi}\sqrt{\frac{R8}{R7}} \times \frac{1}{\sqrt{R2R3C1C2}} \quad f_{NOTCH} = \frac{1}{2\pi}\sqrt{\frac{R6}{R3R5R7C1C2}}$$

Necessary condition for notch: $\frac{1}{R6} = \frac{R1}{R4R7}$

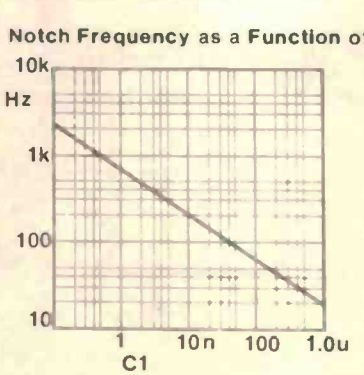
Bi-quad Audio Notch Filter

This notch filter provides good predictability and better noise performance than the state-space approach. Three op-amps from a quad package are employed. For a notch of 3 kHz, R1 is 270k, R2-R3-R5 are 20k, R4 is 27k, R6-R8 are 10k, R7 is 100k, C1-C2 are 1n (use good quality poly or mica capacitors).



Gyrator Audio Notch Filter

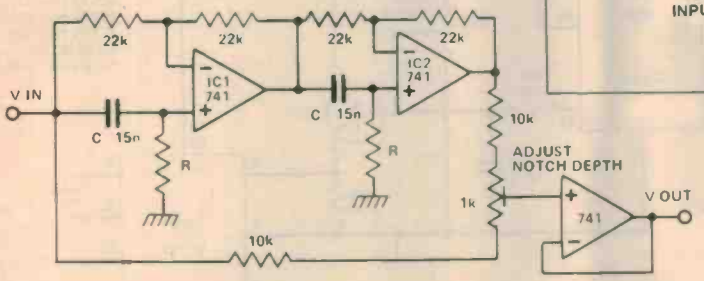
Using two-op-amps from a 4136 quad package, you can implement a very effective notch filter with common component values, the notch frequency ranging from 20 Hz to 2 kHz. Capacitors should be good quality, low voltage metallised poly types.

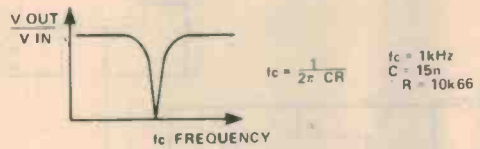


All-pass Notch Filter

This circuit provides adjustable notch attenuation ('depth'). IC1 and IC2 are arranged as 'all pass' filters. They have a flat freqency response but the phase changes with frequency. Overall maximum phase shift is 360°, a phase shift of 180° (reversal) occurring at a frequency of 1/2CR Hz. By mixing the phase-shifted signal with the original, cancellation will form a narrow 'notch' in the frequency response.

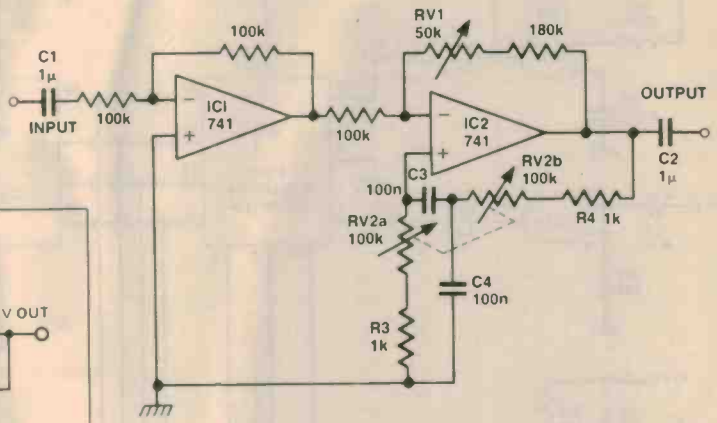
The 1k preset varies the amount of phase-shifted signal mixed with the original so the notch attenuation can be varied. The notch frequency, f_c, can be varied by varying the two resistor marked R. e.g: for a notch at 50 Hz, R should be 220k.





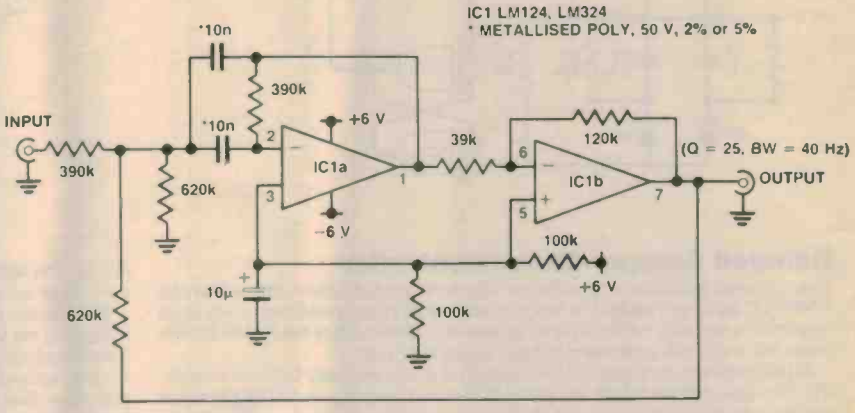
Tunable Audio Filter with Adjustable Selectivity

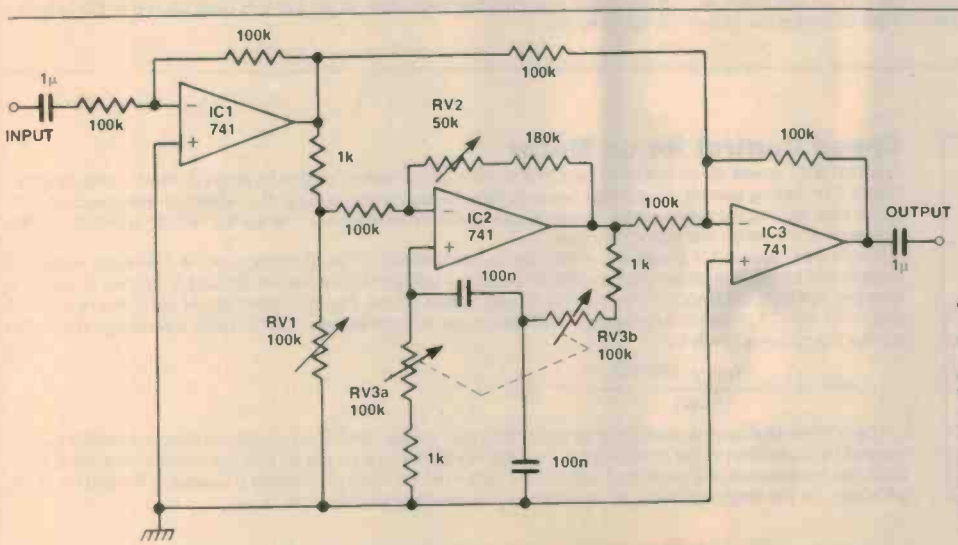
This filter can be tuned from 20 Hz to 1 kHz and features adjustable bandwidth. RV2 sets the frequency, RV1 sets the selectivity. This is a positive feedback control. Advancing it beyond a certain point causes oscillation. Set it just below the point of oscillation for minimum selectivity. The capacitors should be low voltage metallised poly types, 5% or better.



Active 1 kHz Bandpass Filter

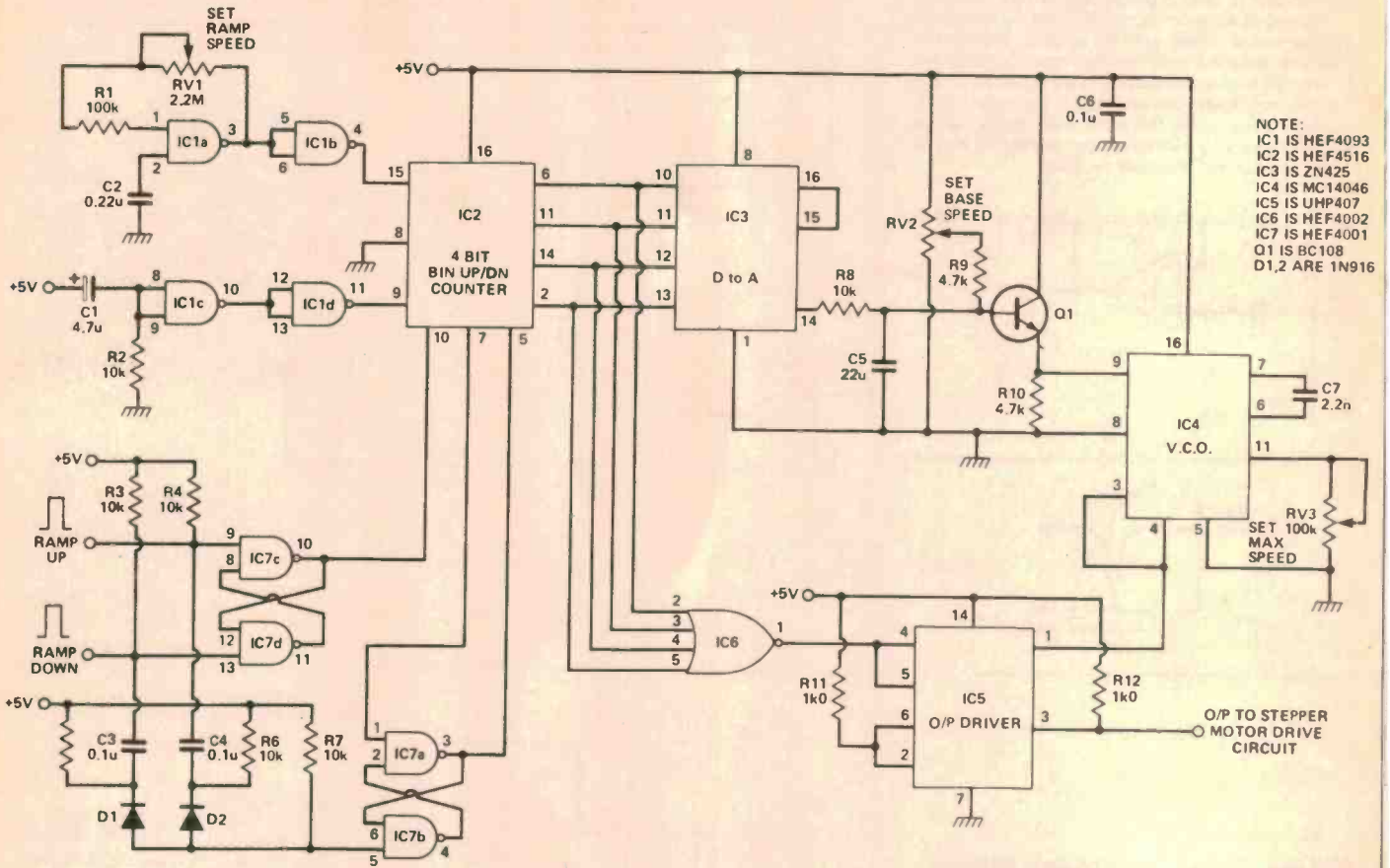
This circuit provides a 40 Hz-wide 'window' at 1 kHz. Two op-amps from a quad op-amp IC are used. For best results, the two 10n capacitors should be metallised poly, low voltage types, with a 2% or 5% tolerance — matched values if possible.





Tunable Audio Notch Filter with Variable Selectivity, Attenuation

This is a modification of the previous circuit to provide a notch, rather than a peak. The original input and the filtered signal are summed in anti-phase at the input of IC3. Hence, the filter circuit provides attenuation at the filter frequency. RV1 sets notch depth, RV2 sets notch width, RV3 sets notch frequency.

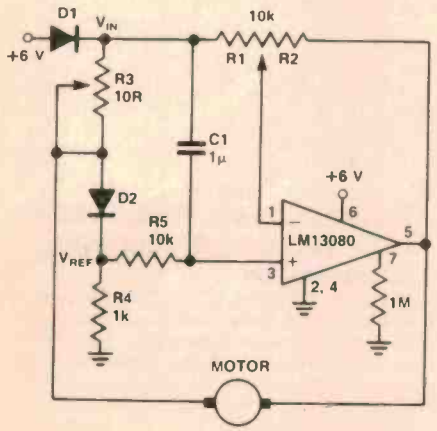


Ramped Stepper-Motor Controller

This has great applications for robotics. When the motor is at rest, the receipt of a RAMP UP pulse will cause the motor to start at its base speed then ramp up to maximum speed and run for as long as required. On receipt of the RAMP DOWN pulse, the motor will slow down to base speed then stop.

IC1a/b provides clock pulses (ramp speed) to a four-bit binary up/down counter, IC2. On receipt of the RAMP UP pulse IC7c/d sets count up and IC7a/b enables the counter. Unless a RAMP DOWN pulse is received the counter will reach its maximum count (max. speed) and hold at this until the RAMP DOWN pulse is received. The latter will set count down and enable the counter which then counts to zero (base speed) and hold again until the next RAMP UP pulse.

The counter output drives the D-to-A converter IC3, the ramping output of this controlling the VCO, IC4. The lower frequency of the VCO (base speed) is set by the bias adjustment of Q1. Upper frequency (max. speed) is set by the 100k pot, RV3. IC5 provides open-collector drive for the output pulse train and also the on/off gate, controlled by IC6, when the counter is set to zero. IC1c/d provides a set zero pulse to IC2 to ensure that the output, at pin 3 of IC5, is off each time the generator is switched on.



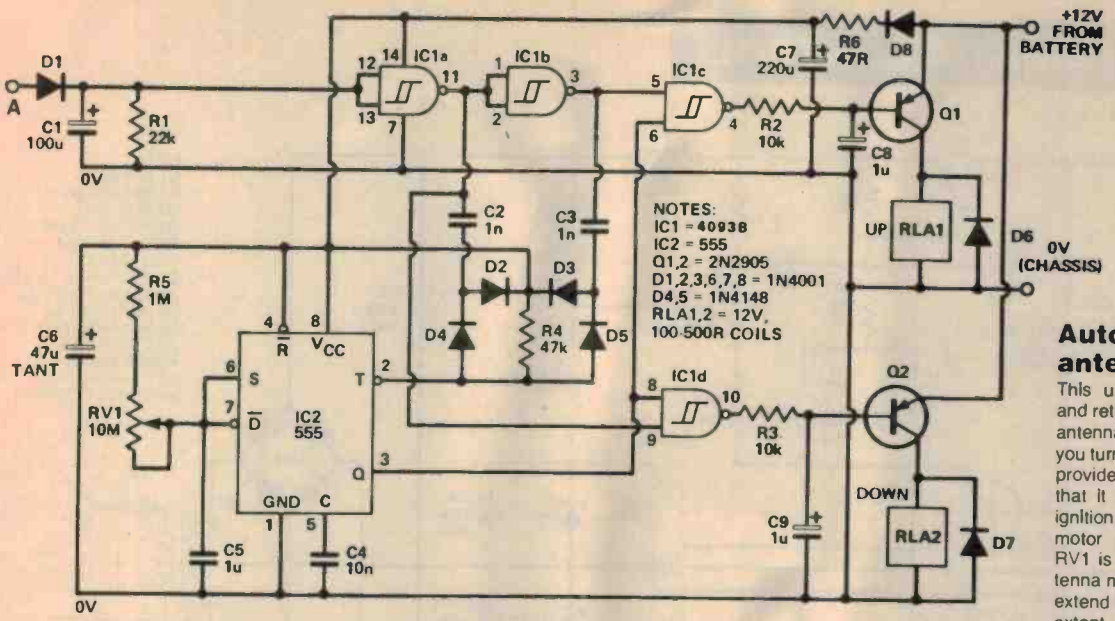
Speed Control for dc Motor

The LM13080 power op-amp is used here to provide a simple speed control for small dc motors requiring less than 0.5 A starting current. This circuit operates by impressing the multiple of a reference voltage across the motor then varying the reference by means of quasi-positive feedback to change the voltage across the motor whenever the load on the motor changes.

It works as follows: D1 brings V_{IN} within the common-mode range of the op-amp. A reference voltage is established by the combined voltage drop through the 10R pot R3 and diode D2 and is applied to the non-inverting input of the LM13080. Resistor R4 is used to bias D2 on. The 10k speed adjust pot is two resistors in one — R1/R2. R1 is the input resistance, R2 is the negative feedback resistance. Thus, the voltage impressed across the motor is given by:

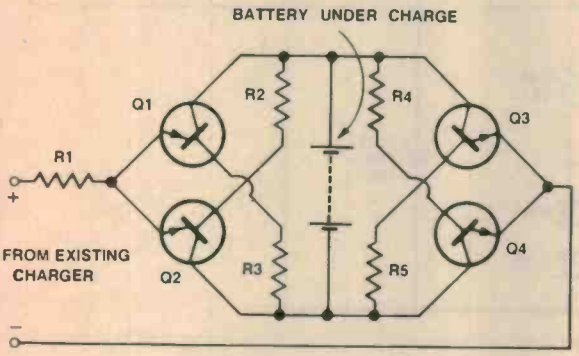
$$V_{MOTOR} = \frac{(V_{BE2} + I_3R3)R2}{R1} + V_{BE}$$

The positive feedback is developed as a change in the voltage across R3 due to the change in motor current caused by a variation in the motor's load. Resistor R3 is shown as a pot so that the amount of positive feedback can be adjusted to smooth operation of the motor (no 'hunting' or 'cogging'). Capacitor C1 and R5 serve as a filter for the fererence voltage. Use a polyester low voltage capacitor.



Automatic car antenna

This unit provides automatic extend and retract for an electrically driven car antenna. The input at A senses when you turn the ignition on and the up relay provides drive for the antenna motor so that it extends. When you turn your ignition off, the down relay reverses the motor drive, retracting the antenna. RV1 is set to provide drive to the antenna motor for sufficient period to just extend or retract the antenna to the full extent. It can be permanently connected as current consumption is under 10 mA. Use tantalums or low-leakage electrolytics for the polarised capacitors.

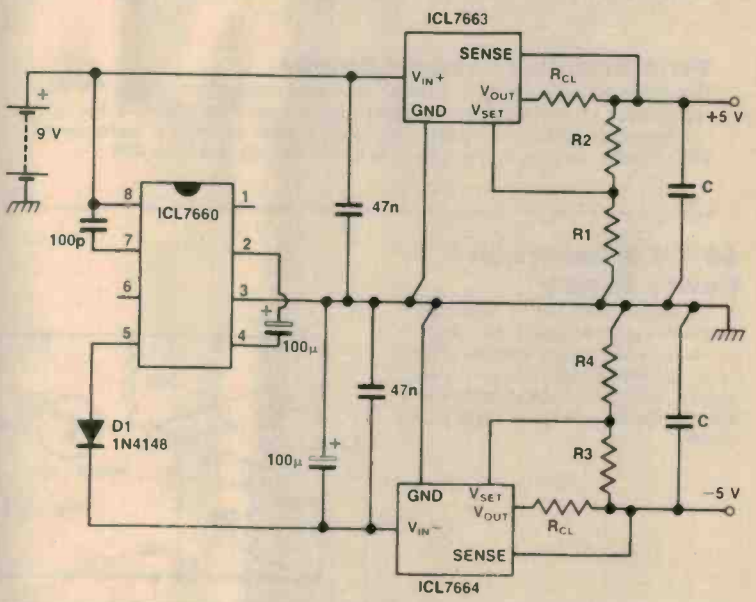


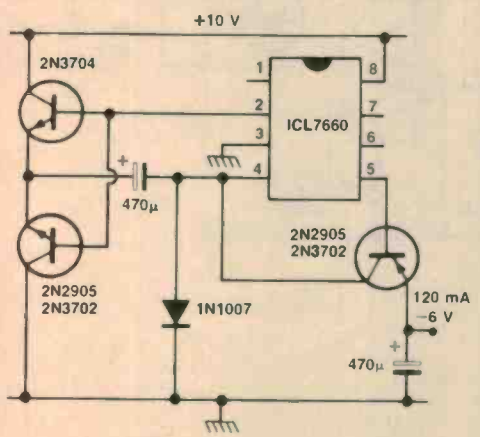
Nicad Polarity Saver

Avoid charging your Nicad batteries back-to-front — which will certainly destroy them. Residual battery potential determines the charging polarity by switching on either the pnp or npn transistors. Thus, this will not work with completely discharged Nicads. Resistor R1 is simply there for charging current limiting. If your charger has current limiting, omit R1. For a 3 V charger, R2-R5 can be around 1k8-2k2. Suitably-rated silicon transistors can be used (i.e: TP31B). Use germanium types for single cells (1.2 V).

Dual 5 V Rails from a 9 V Battery

A 7660 positive-to-negative rail inverter is used here in conjunction with a pair of CMOS IC regulators, a 7663 for the positive rail and a 7664 for the negative rail (all ICs from Intersil, second-sourced by Teledyne). These regulators draw only 3.5 µA quiescent current but will regulate up to 40 mA output current. Output voltages are determined by the ratios of R2:R1 and R3:R4. The 47n capacitors on the regulator inputs should be ceramic types and are there to prevent instability. Circuit continues to function at battery voltages down to 6 V.

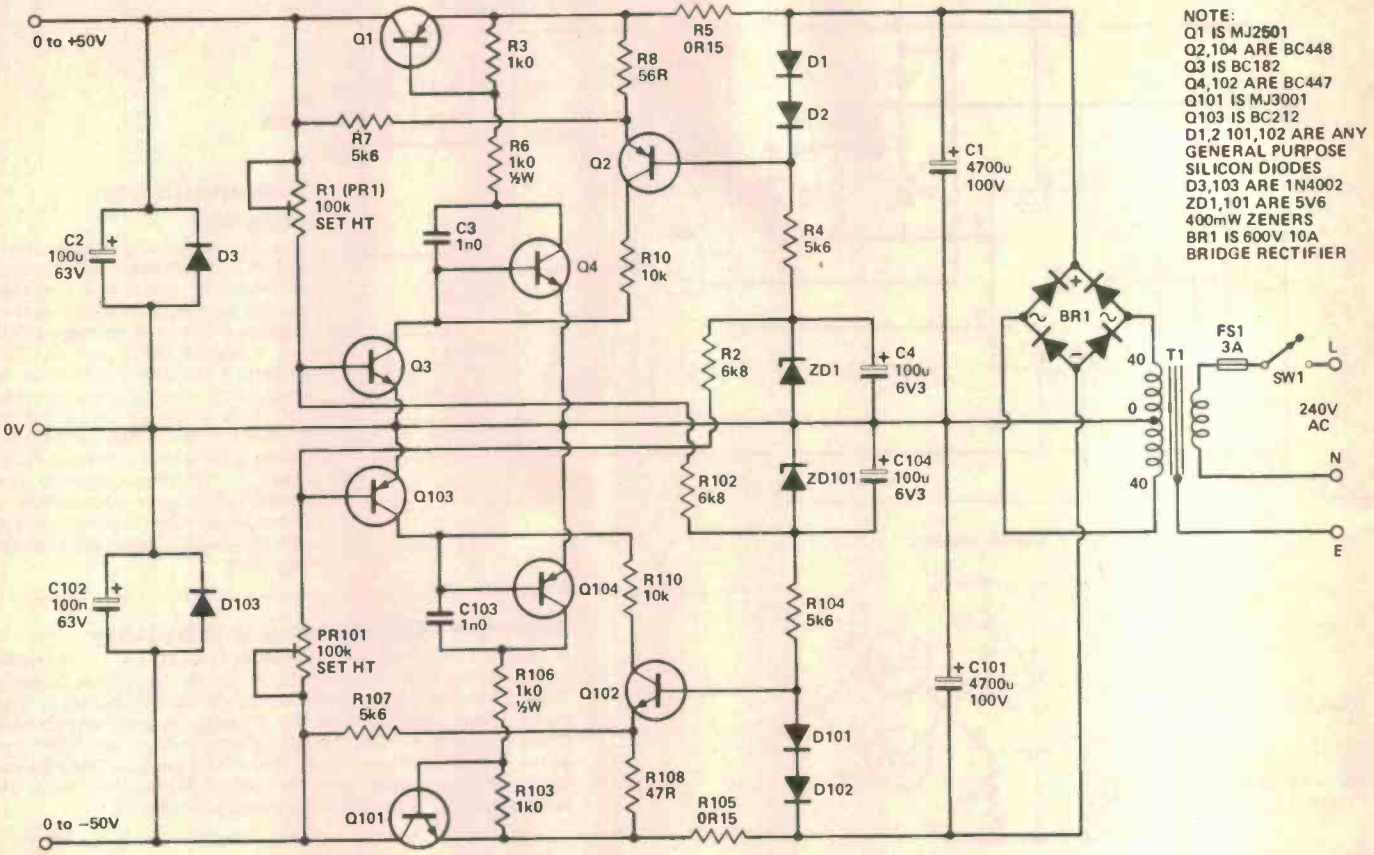




High Current Voltage Rail Inverter

The ICL7660 (TSC7660) is a positive-to-negative power supply rail inverter. It will only supply low current output though. This circuit boosts the output so that some 120 mA can be drawn from the negative rail provided by the 7660.

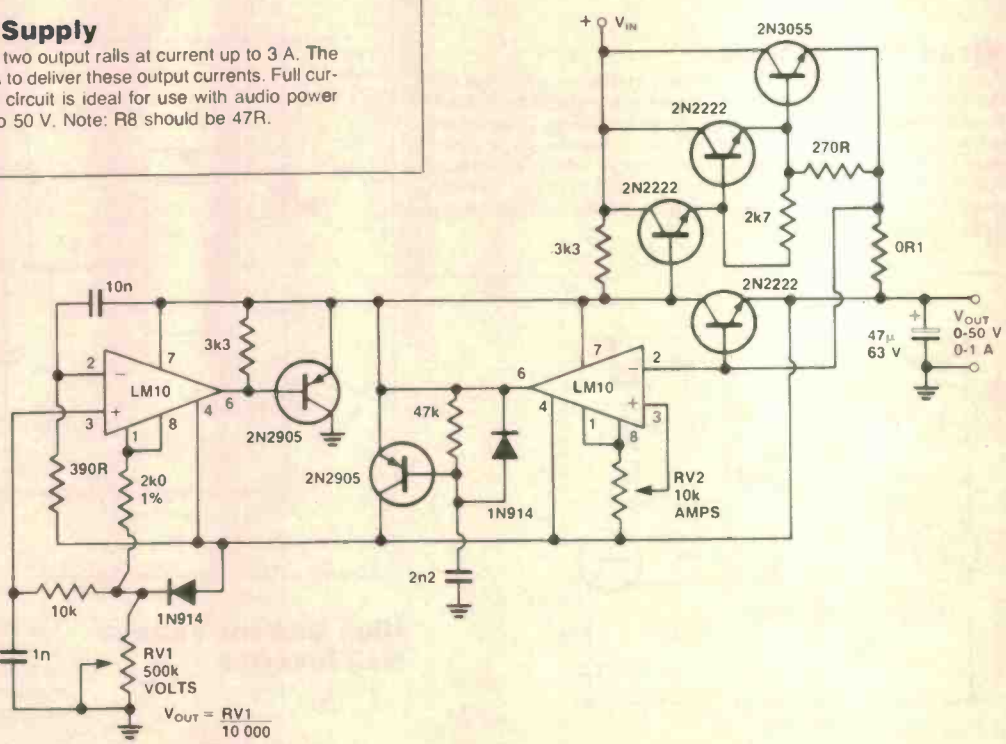
▶



NOTE:
Q1 IS MJ2501
Q2,104 ARE BC448
Q3 IS BC182
Q4,102 ARE BC447
Q101 IS MJ3001
Q103 IS BC212
D1,2 101,102 ARE ANY GENERAL PURPOSE SILICON DIODES
D3,103 ARE 1N4002
ZD1,101 ARE 5V6 400mW ZENERS
BR1 IS 600V 10A BRIDGE RECTIFIER

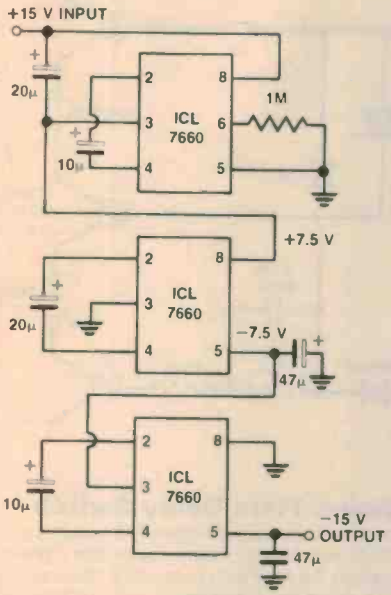
Twin Stabilised Power Supply

This circuit will deliver up to 50 V on the two output rails at current up to 3 A. The secondary of T1 must be rated at 4.5-5 A to deliver these output currents. Full current limiting protection is provided. This circuit is ideal for use with audio power amp modules requiring supply rails up to 50 V. Note: R8 should be 47R.



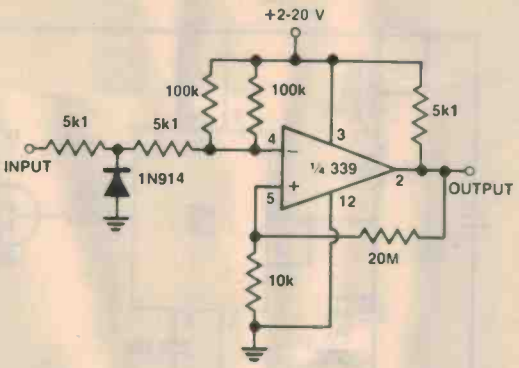
50 V/1 A Laboratory Power Supply

A series-pass regulator is employed here with separate circuits for voltage reference and current limiting. The input voltage should be at least 55-60 V, well filtered. The LM10 has an internal reference, which is made use of here.



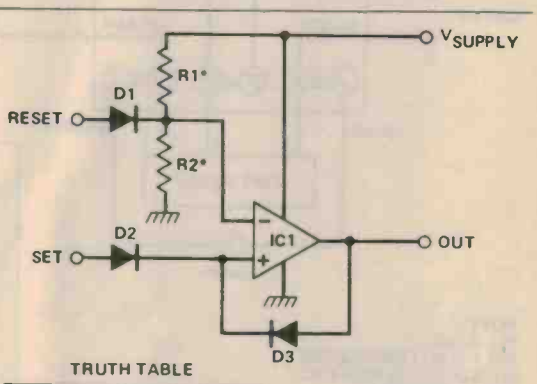
+15 V to −15 V Supply Rail Inverter

Cascading three 7660 positive-to-negative rail inverters to obtain −15 V from a +15 V supply. Output impedance is about 250 Ohms, so it won't supply much current.



Zero-Crossing Detector

The output of this circuit goes high at a negative-going zero-crossing, low at a positive-going zero crossing. The input can be a sine, square or complex wave.



TRUTH TABLE

SET	RESET	OUT
0	0	NC
0	1	0
1	0	1
1	1	1

NC = NO CHANGE

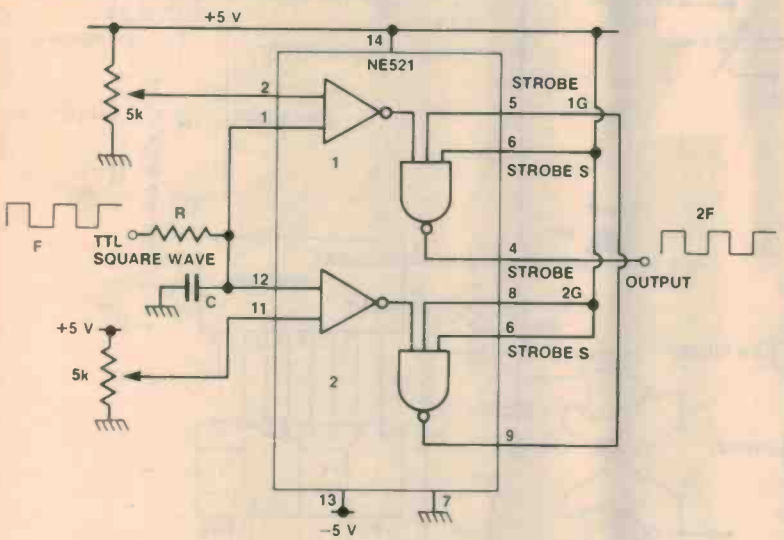
*SEE TEXT

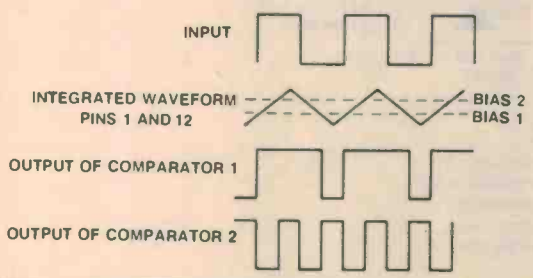
NOTE:
IC1 IS ANY OP-AMP
D1-3 ARE 1N4148

Op-amp RS Flip-Flop

While CMOS or TTL gates are commonly used to make an RS flip-flop, op-amps can serve the same function and are often overlooked, particularly in analogue circuits where the simple RS digital function is required and using digital gates would be 'overkill'. With this circuit, you can exploit a spare op-amp from a dual or quad package. Any op-amp may be used. The high and low voltages at the output are only a function of the op-amp's internal output drive configuration.

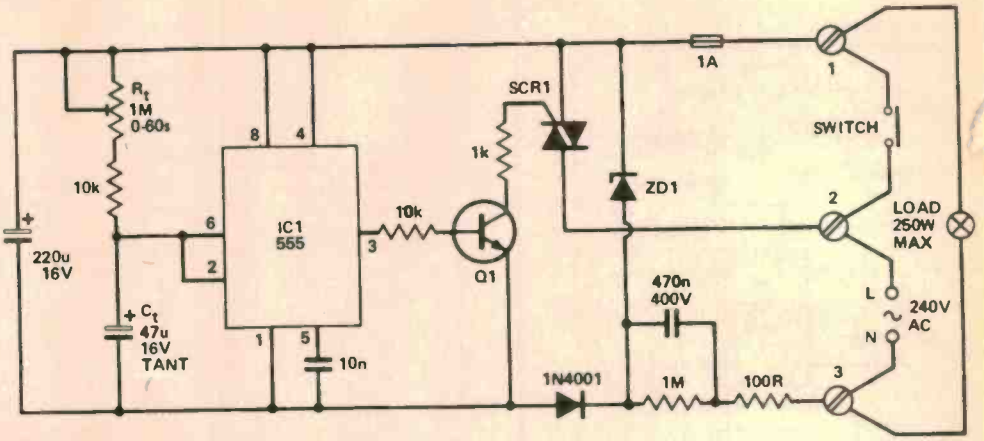
Resistors R1 and R2 should be chosen so that R2 = 2.4R1 and R2 is less than V_{supply} divided by 0.05. All changes of state occur on the input low-to-high transition.



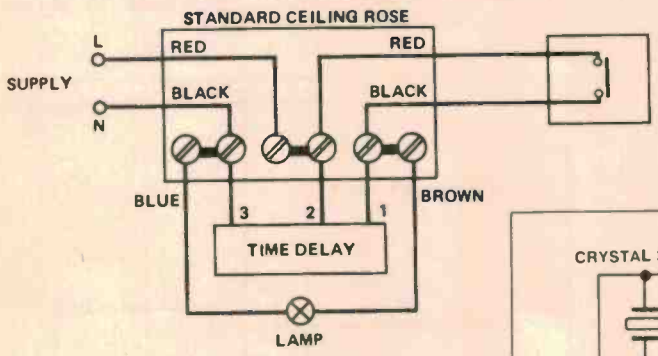


Digital Frequency Doubler

Digital frequency dividers are commonplace, but digital multipliers are not. This circuit employs the NE521 dual differentail comparator. The input is integrated, the triangular resultant being applied to the two comparator non-inverting inputs. Setting the two 5k bias pots appropriately will provide a doubled output. This will work right up to 50 MHz with the NE521.



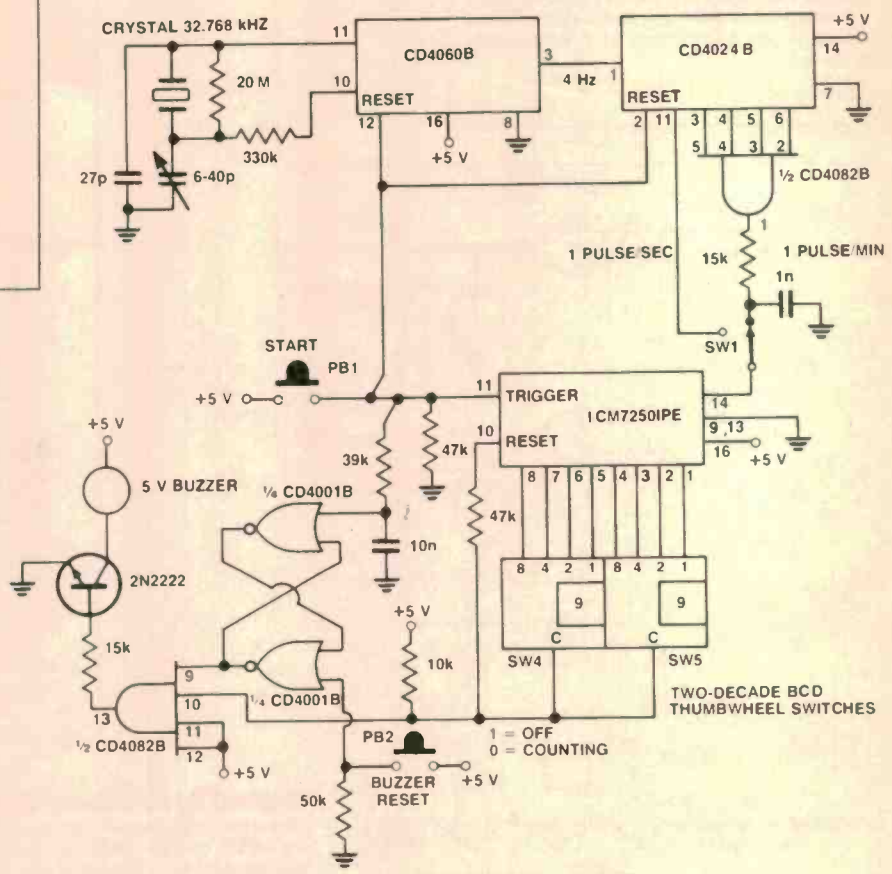
TYPICAL CONNECTION SCHEME



NOTE:
IC1 IS 555
PIN 7 IS NOT CONNECTED
Q1 IS BC337, ZTX300 ETC.
SCR1 IS TIC 206
ZD1 IS 12V ZENER

Mains Time Delay Switch

Ideal for a corridor light timer. The switch is a main-rated momentary action pushbutton. When it's pressed, the timer will operate for a time equal to 1.1 R_tC_t. At the end of this period, both the load and the circuit are disconnected.



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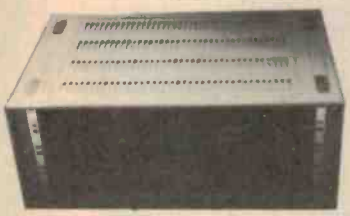

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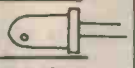

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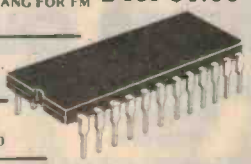

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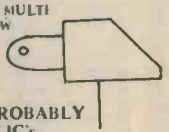

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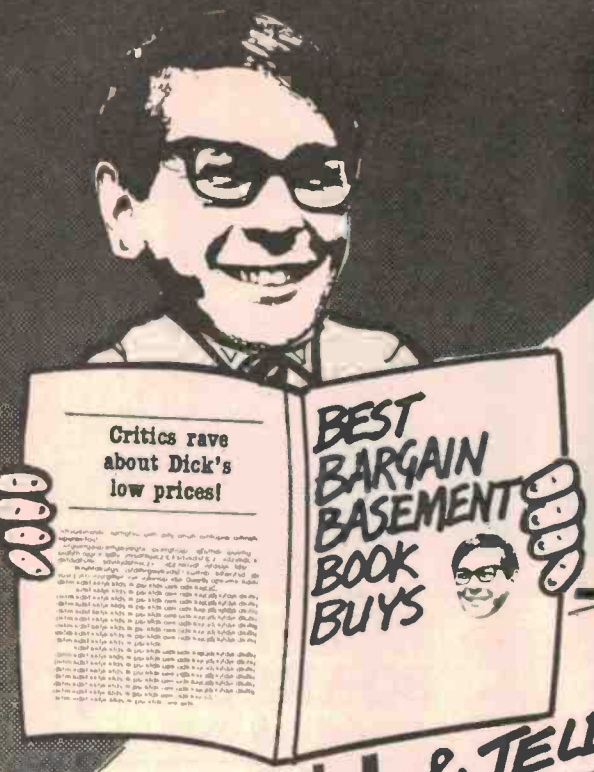

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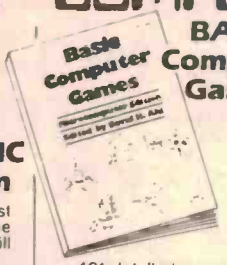

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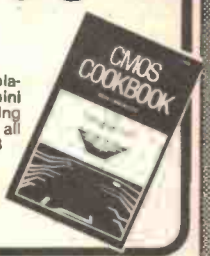

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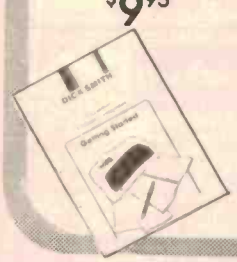

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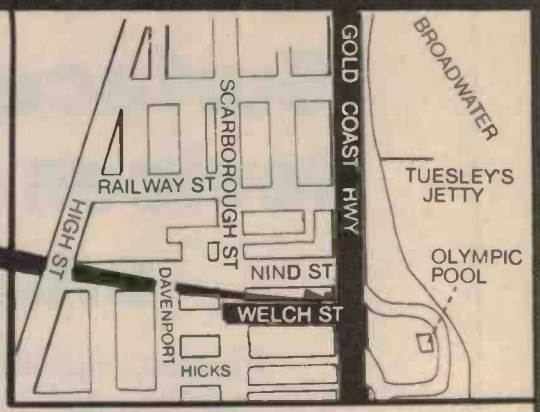

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Surface acoustic wave devices — fundamentals and applications

The basic physics of SAW devices was examined in part 1. In this article a major application of time coded SAW filters, spectrum analysis, is explained.

P. J. Hall
Physics Department, University of Tasmania

Part 2

THE THIRD MAJOR use of time-coded SAW filters is in spectrum analysis and, as in chirp radars, the basic component is the dispersive delay line (Figure 10).

Before examining SAW spectrum analysis methods, it is useful to consider alternative techniques and their limitations. This section is mainly concerned with analysis systems designed for on-line signal processing applications. In such applications, spectrum analysis is used to obtain information about signals on a real-time 'as the action happens' basis, perhaps in order to control some other process e.g: the electrical steering of an antenna array to minimise interference to a radio link.

The most obvious way of analysing a given bandwidth is to assemble a bank of frequency contiguous filters covering the analysis bandwidth and to relate the output of each filter to the spectral energy falling within the passband of that filter. Filterbanks are commonly used in audio, radio astronomy and some military applications with refinements dependent upon the specific use.

Unfortunately, when a large bandwidth is to be analysed with good frequency resolution, the number of filters becomes prohibitively great and the analyser becomes large, expensive, difficult to align, and difficult to keep in alignment. Filterbanks consisting of SAW bandpass filters are now available and offer an excellent alternative to LC filters in some RF applications, although in most situations the more elegant SAW techniques to be described would normally be used.

Spectrum analysis

Conventional scanning spectrum analysers are acceptable for laboratory use but are too slow and too wasteful of signal energy to be used in most signal processing roles. A signal shorter than the time the analyser takes to scan the analysis bandwidth can come and go without ever registering on the instrument.

In military jargon, the analyser has a very low probability of intercept (POI). If the scan rate is increased to raise the POI, the available frequency resolution is decreased. The scanning analyser wastes energy because if 'N' frequency resolution cells are resolved across the analysis bandwidth, the time spent actually looking at each cell is only 1/Nth of the total observing time.

Digital spectrum analysers based on the Fast Fourier transform (FFT) algorithm are

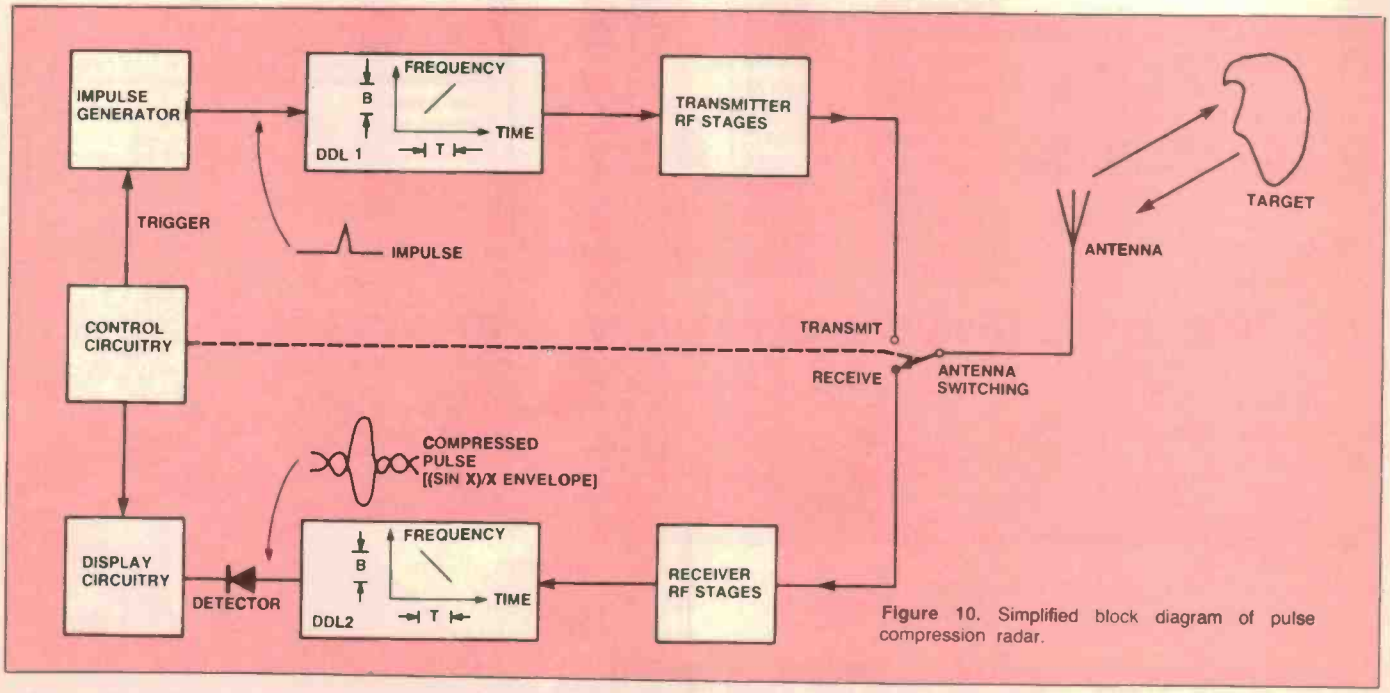

Figure 10. Simplified block diagram of pulse compression radar.

now familiar in audio test and development laboratories as well as in some signal processing applications. FFT methods produce accurate spectra and are capable of conveniently providing a true Fourier transform i.e: phase as well as amplitude, or power of spectral components. Unfortunately, the analysis bandwidth for real-time FFT processors is currently rather limited with most commercial units being essentially audio analysers.

A second digital method of power spectrum analysis, the auto-correlation technique, can be extended to wide bandwidths but is not suitable as a general approach, particularly in applications where high time resolution i.e: large number of spectra per second is needed.

Another instrument sometimes used for spectrum analysis in radio astronomy and military applications is known as the acousto-optical spectrum analyser. This device relies on the interaction of laser light with RF sound waves in a translucent piezoelectric crystal. Wide bandwidths can be analysed with good frequency and time resolution but current designs are plagued with a number of practical problems, the most serious being mechanical and thermal instability and limited dynamic range.

Coherent (phase sensitive) acousto-optical processors have been described but with existing technology, practical problems in such systems are acute. Integrated acousto-optical processors which utilise the interaction of light from a solid state laser with surface acoustic waves may substantially avoid the problems of existing optical analysers.

SAW dispersive delay line spectrum analysers overcome many of the disadvantages of the other types of instruments and offer a state-of-the-art solution to the problem of real-time, wideband Fourier analysis.

Compressive receiver

A block diagram of a SAW 'compressive receiver' spectrum analyser is shown in Figure 11. This configuration, which is only one of several possible arrangements, uses two SAW dispersive delay lines (DDLs) similar to the type used in the chirp radar system described earlier.

One DDL is used to expand an impulse into a chirp, and this chirp is then mixed with signals in the band to be analysed. Consider CW input signals for simplicity. Each signal produces a chirp from the mixer which is time co-incident with, but offset in frequency from the other chirps. This is illustrated in the frequency-time diagram for the process (Figure 12).

Signals spaced in frequency at the input produce chirps which enter the passband of the second DDL, the convolver, at different times. The chirp slope of the convolver is the exact inverse of the expander DDL chirp slope so chirps entering the convolver emerge as compressed pulses, just as in the pulse compression radar. In this case however, chirps due to different input frequencies enter the convolver at different times, so the compressed output pulses are separated in time.

Hence, separation in frequency at the compressive receiver input produces separation in time at the output, so the instrument functions as a spectrum analyser. The time axis on a display device e.g: an oscilloscope can be read as frequency by using the convolver chirp slope as a scaling factor, i.e: $f = (B/T)t$. This process is an example of the 'chirp transform' and, as mentioned earlier, other practical implementations are possible.

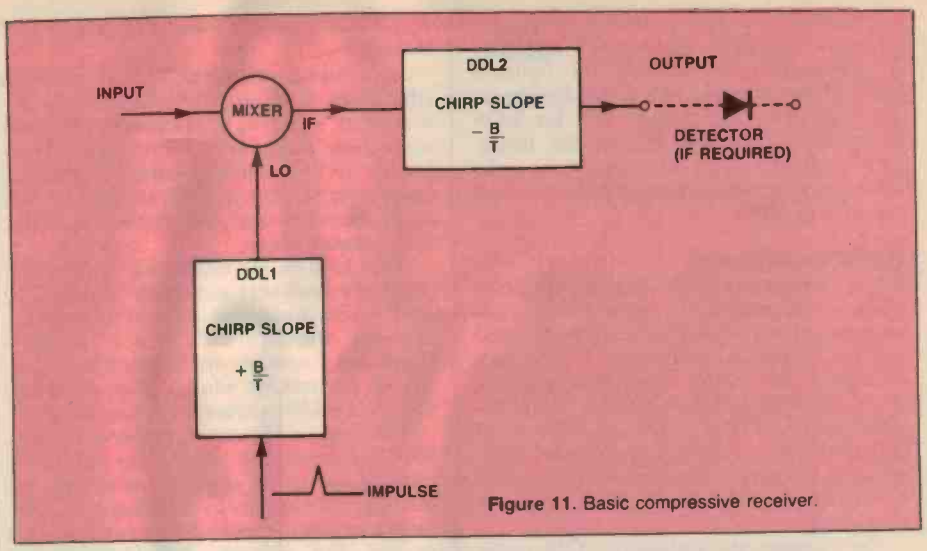

Figure 11. Basic compressive receiver.

Several key characteristics of the compressive receiver are related to the time-bandwidth product, $N = BT$, of the convolver. As expected, the width in time of the compressed pulses is of the order of the reciprocal bandwidth, 1/B. The receiver takes T seconds to analyse the total bandwidth, B. The number of identifiable frequency resolution cells is therefore about T/(1/B) or N, so the time-bandwidth product is analogous to the number of channels in a filterbank or the number of points in a digital FFT analyser. The equivalent width in frequency is simply B/N or 1/T.

It can be shown that if a compressive receiver is designed to give a frequency resolution equivalent to a scanning spectrum analyser, the compressive receiver can analyse the input bandwidth a factor of N faster than the scanning analyser. Since N can be up to 20 000 with currently available SAW devices, the advantage can be very large. As shown in Figure 12, it is usual to use an expander chirp with twice the bandwidth and duration of the convolver impulse response.

This ensures that chirps due to signals at either edge of the analysis bandwidth emerge from the convolver fully compressed, but it also means that chirps due to some very short duration input signals can fall outside the convolver bandwidth for part of the active cycle of the receiver. ▶

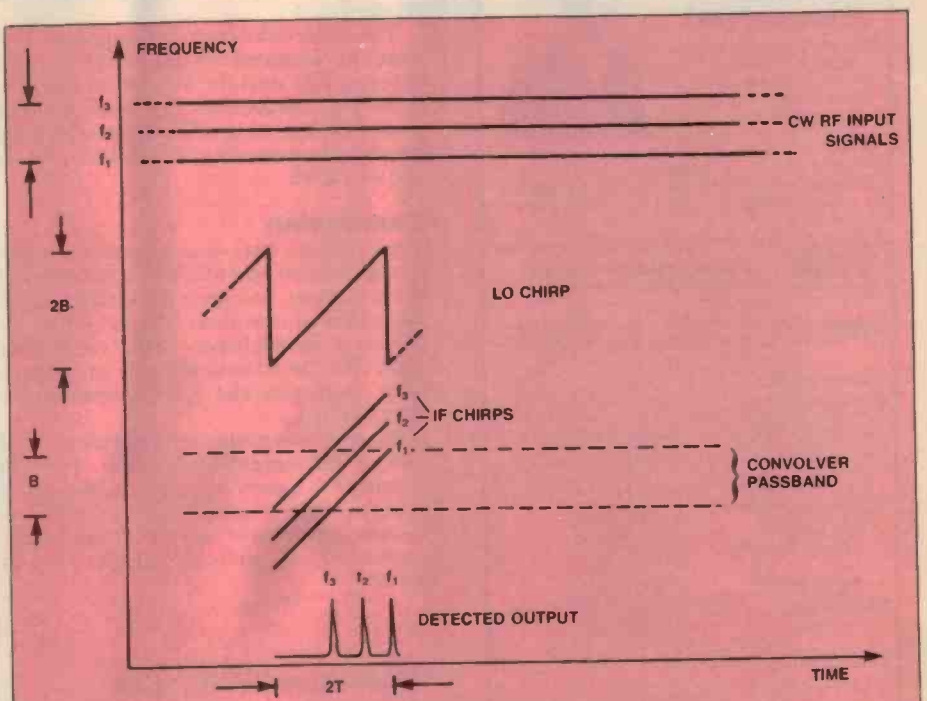

Figure 12. Frequency-Time diagram for compressive receiver. Note the duality between frequency at the input and time at the output.

The effect is to lower the POI to 50% for signals of duration less than T (typically microseconds). Nevertheless, this figure is much higher than the POI factor for almost all other analysers. A high POI for SAW compressive receivers makes the instruments popular with military users, who often use more advanced techniques to raise the POI to 100%.

SAW analysers

When compared with digital spectrum analysis techniques, the most obvious advantages of SAW analysers are high speed and wide analysis bandwidth. It has been estimated that SAW analysers exhibit a speed advantage of from 100 to 10 000 depending on the DDLs used and the type of digital instrument used as the basis for comparison. In certain applications the overall benefit of adopting SAW technology can be very great.

For example, the authors of a U.S. paper describing a sophisticated SAW signal processing module claim an advantage factor for SAW technology over digital methods of 12 000. This figure is based on a system figure of merit defined as 'the equivalent number of complex multiples per second per dollar of development cost'.

SAW processors are similar to digital instruments in that both are capable of providing amplitude and phase spectra and, as such, are useful in roles requiring coherent signal processing. Part of the recent work in radio astronomy at the University of Tasmania has been to demonstrate that coherent SAW spectrum analysers are viable now, using existing technology and techniques.

In contrast, coherent optical methods (the main rival to SAW technology for wideband, real-time applications) are some way from being fully developed. As a bonus, SAW technology offers a dramatic improvement over optical methods in the areas of mechanical and thermal stability, and dynamic range.

The limitations associated with SAW spectrum analysers are fairly minor. The analog transformation process exhibits an accuracy equivalent to a 6 or 7 bit digital transform. For many applications this is sufficient, particularly when the speed advantage of a SAW instrument is considered.

The second practical problem is that SAW analysers are simply too fast to be directly useful in applications where the instruments need to be interfaced to computers or other digital post-transformation devices. For example, two University of Tasmania spectrum analysers output data at a rate of around 40 ns per frequency resolution cell, and this is the rate at which a digital processor needs to sample the detected output.

We have solved the problem by producing 'digital video integrators', or DVIs, to act as an interface between the SAW analysers and slower logic. A DVI samples the analyser output at high speed and adds together many spectra before the integrated spectrum is output to a computer or other device. The DVI runs continously so there is no loss of new data while the integrated spectrum is output.

This process degrades the time resolution slightly but, even so, the integrated spectrum time resolution can approach 100 μs with existing data acquisition computers. Of course, the wide-band, coherent processing capability of SAW spectrum analysers is retained.

The DVI techniques developed in Tasmania have created interest overseas, and it is hoped that with the local VLSI program underway, further work can be undertaken on the design of an Australian produced parallel processor ship for use in the back-end of a DVI.

Conclusion

These articles have summarised some important current uses of SAW technology but the treatment has been necessarily brief. Discussion of important devices such as reflective array compressor (RAC) dispersive delay lines, non-linear acoustic convolvers, SAW oscillators and SAW memories has been omitted.

Interested readers are referred to the general references listed below. For the benefit of designers considering using SAW devices I have provided a list of suppliers known to me. Most companies can supply customised as well as standard stock devices.

GENERAL REFERENCES

1. Butler, M.B.N., 'Surface acoustic wave devices', *Electronic Engineering*, June 1980, July 1980, February 1981.
2. Dieulesaint, E. and Royer, D., *'Elastic waves in solids'*, Wiley, 1980.
3. Hartmann, C.IS. et al., 'SAW devices for military, communications, radar and EW systems', *Microwave Journal*, July 1982.
4. Oliner, A.A. (Ed.), *'Acoustic surface waves'*, Springer-Verlag, 1978.
5. Penimuri, D. and Havens, D.P., 'Surface acoustic wave filters prove versatile in VHF applications', *Electronics*, July 5, 1979.

SAW DEVICE SUPPLIERS

1. Andersen Laboratories Inc., 1280 Blue Hills Avenue, CT 06002, USA. TWX 710-425-2390.
2. Crystal Technology Inc., 1035M E. Meadow Cir., Palo Alto, CA 94303, USA.
3. GEC — Marconi Research Centre, Great Baddow, Essex, CM2 8HN, U.D. Telex 99201.
4. Hughes Aircraft Company, Gound Systems Group, P.O. Box 3310, Fullerton, CA 92634, USA.
5. Racal-MESL Ltd., Lochend Industrial Estate, Newbridge, Midlothian, EH28 8LP, U.K. Telex 72384.
6. RF Monolithics Inc., 4441 Sigma Road, Dallas, Texas 75234, USA.
7. Siemens Ltd., Australian Office, 544 Church Street, Richmond, Victoria, 3121. Telex AA30425.
8. Signal Technology Ltd., Cheney Manor, Swindon, Wiltshire, SN2 2PJ, U.K. Telex 444410.
9. Thomson-CSF, Chemin des Travails, B.P. 53, 06802 Cagnes-Sur-Mer, France. Telex 204.780F. ●

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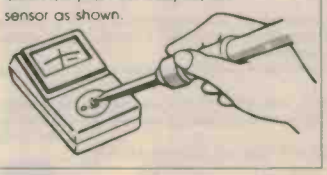

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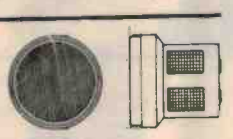

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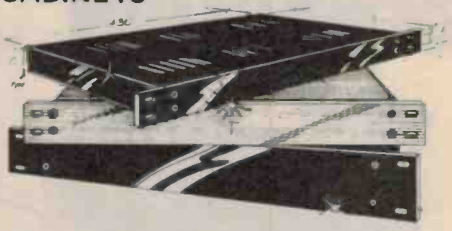

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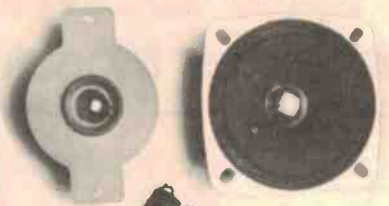

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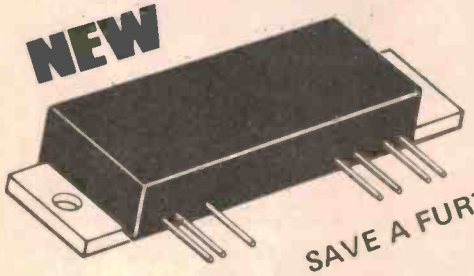

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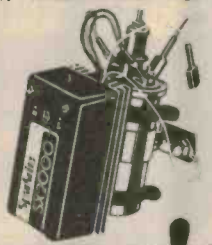

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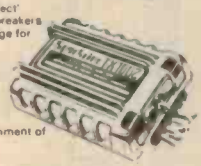

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Modulation Acceptance:	NFM ±7.5KHz		
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Economy analogue frequency meter

H. Nacinovich of Gulgong NSW says that this circuit is simple, easy to build and get going, and uses very little standby power.

There is no reason why it could not run off a 9 V radio battery but some form of power supply voltage regulation is recommended.

The circuit might be built into a suitable case, complete with a meter, or it could be used as an outboard adaptor (i.e: minus meter movement) which can be plugged into an ordinary multimeter.

Alternatively, although I have not tried this, it could be built into an existing multimeter case. For example, if a spare multimeter is on hand one might be willing to sacrifice, say, the 'Ohms' ranges and convert the associated switch positions to 'Frequency' ranges. The modification should not be beyond the ingenuity of most hobbyists.

Another possibility is to incorporate it into an audio signal generator.

I must confess that the circuit does not involve any new ideas. However, I have not seen any analogue frequency meter projects published recently. So, I thought that this project might be appreciated, if not by the advanced enthusiast, then at least by the newcomer or one with limited cash and limited spare time.

There have been plenty of digital frequency meter circuits published recently. Bearing in mind the performance capability of such circuits and the relatively low cost of digital ICs these days, the popularity of DMFs is not surprising. Even so, I would not consider a DFM either a simple or a cheap project to build.

Despite all the obvious advantages of a DFM there are many situations in which one might get by quite happily with an analogue meter which covers the audio to sub-radio spectrum and has about the same order of accuracy as, say, an ordinary multimeter. Now, if such a device could be built using a single, low cost IC, a few passive components, a simple power supply and, possibly, a meter which is already on the workbench or lying idle in a cupboard somewhere, well . . .

The circuit described has the best balance of the desired features. I incorporated it into a Wien bridge-type audio oscillator which I had previously built and used the meter to monitor the output frequency.

The obvious advantage of this arrangement is that I need not rely on the dial calibration which is subject to too many sources of error. From tests I have made to date, the linearity and stability which can be obtained with the circuit are surprisingly good over the entire range of my oscillator, 20 Hz to 200 kHz.

The circuit shown in Figure 1 is based on the use of CMOS NAND gates in a simple monostable configuration. It produces an output current signal which is linearly proportional to the input frequency.

Two gates, IC1b and IC1c of a quad package form the heart of the monostable. IC1a and IC1d are employed as input and output buffers respectively. Their purpose is mainly to square up any rounded corners on the input and output signals.

The output from IC1d is in the form of a series of positive rectangular pulses of constant width (determined by the time constant R1C1) and a frequency equal to the input frequency. These pulses are integrated and the resultant signal is applied to a meter movement of suitable sensitivity.

I used an ordinary multimeter movement with 30 μA FSD sensitivity but there seems to be no reason why a less sensitive movement (e.g: 1 mA FSD) could not be used provided that the values of R2, R3 and VR1 are adjusted accordingly.

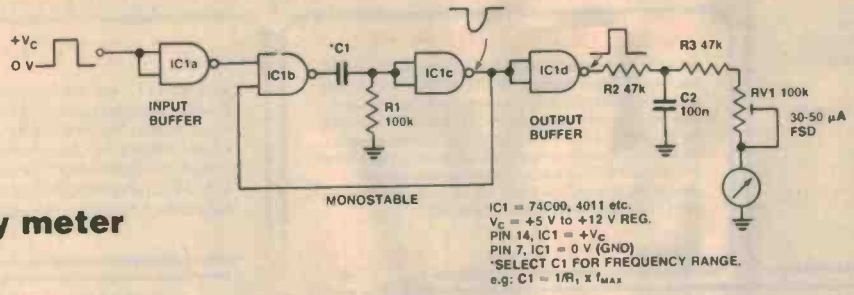

Figure 1. Simple monostable configuration.

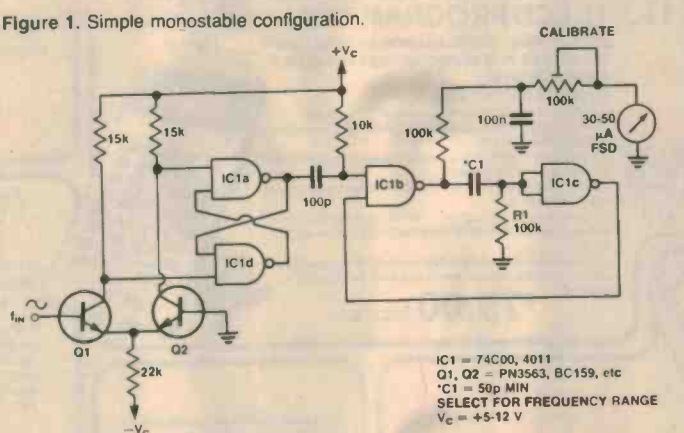

Figure 2. Modified frequency meter.

R1	C1	Theoretical max. frequency of measurement	Recomm. calibration FSD
100k	100n	143 Hz	100 Hz
100k	10n	1.43 kHz	1 kHz
100k	1n	14.3 kHz	10 kHz
100k	100p	143 kHz	100 kHz

Calibration will depend on the choice of component values, the meter sensitivity and on variations between ICs from different manufacturers. Thus some experimentation with component values may be necessary and the values shown are therefore meant as a guide only.

With any combination of R1 and C1, the upper limit of frequency which can be measured will depend on the product R1 C1. As a rough rule of thumb choose R1 C1 to be equal to $1/f_{max}$, where f_{max} corresponds to the chosen input frequency for full scale deflection.

Then, with an input signal of known frequency adjust VR1 for a suitable meter deflection. It is possible to cover different frequency ranges simply by switching in different values for C1, leaving all other component values as they are. For example, to increase the range by 10, reduce the value of C1 by 10, and vice versa. Some trimming of component values may be necessary.

Calibration will also depend on the supply voltage which should be regulated. I have used a 12 V mains powered regulated supply, but if a 9 V battery is used I would recommend the use of a series regulator with low standby current, such as the μA105.

Figure 2 is a modified version of Figure 1 and it gives a very good performance. It is useful when the input signal needs to be conditioned, such as low level sine waves, to produce a square wave input to the monostable portion of the circuit.

Basically, IC1a and IC1d are wired as a flip-flop which changes its output state with a snap action when the inputs to these gates alternately go low. There are a number of different ways of driving such a flip-flop, but in this case I chose to use a pair of transistors connected as a differential amplifier.

This has the advantage that it can be dc coupled to low frequency, ground referenced signals and it also gives a modest amount of signal amplification. However, this arrangement does need a dual power supply. The input sensitivity is better than 200 mV p-p, depending on the gain of the transistors and the supply voltage. ▶

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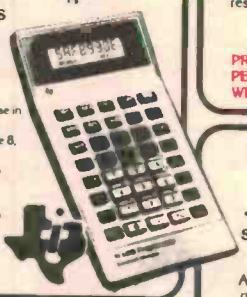

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Dot graphics density:	Dot graphics density up to 1280 dots per line.
Ribbon:	cartridge type.
Columns/line:	Normal size – 80 columns. Double width – 40 columns. Compressed print – 142 columns. Compressed/double width – 71 columns. The above can be mixed in a line.
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Paper type:	Fanfold Single sheet. Thickness – 0.05mm (0.002") to 0.25mm (0.01"). Paper width – 101.6mm (4") to 254mm (10").

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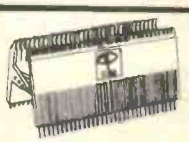

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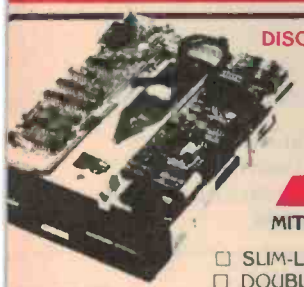

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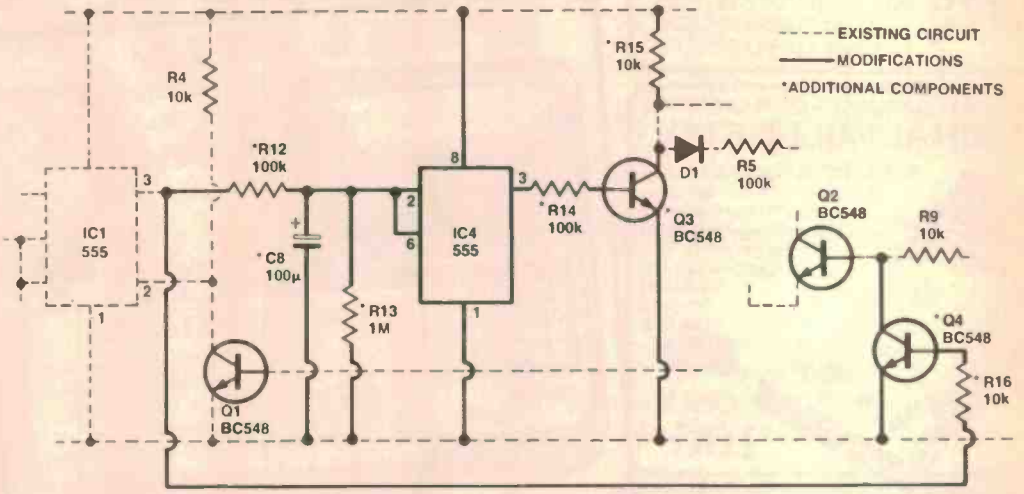
These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.

Car alarm modification



Anthony Park of Middle Cove has come up with a modification to the car alarm project, ETI-084. It provides an entry delay system, removing the need for an external switch and making the alarm easier to install, more convenient to operate and more difficult for thieves to disarm.

As the original alarm design allows for unlimited exit time, the modification required is simple yet more sophisticated than the usual entry/exit delay systems. And best of all, the extra parts should only cost about $1.

When the alarm is triggered pin 3 of IC1 goes low (about 0.6 V). This action initiates the entry delay provided by IC4, C8 and R13. C8, normally charged at 12 V, begins to discharge through R13 and after ten seconds or so the voltage at pins 2 and 6 of IC4 reaches 4 V.

This action sets pin 3 high, thus turning on Q3 and allowing the relay to pulse via Q2 and also trigger off the 45 second reset delay as previously designed. After this delay time, pin 3 of IC2 goes high, switching on Q1 which resets IC1, followed by IC4 and IC2, completing the sequence.

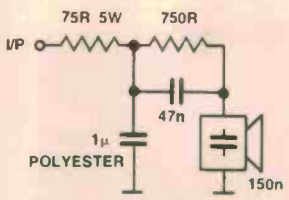
The only change to circuit performance is that there is a delay time before the circuit is fully reset due to the time required to charge C8. This should not pose any problems except when the alarm is initially turned on, taking about 17 seconds to charge C8 fully.

The purpose of Q4 is to disable Q2 so that the relay is not pulsed while C8 is charging, otherwise the horn would be beeping for 17 seconds when the alarm is first turned on.

This modification is very simple to install as only one track, from pin 3 of IC1, on the pc board has to be cut. All the other connections can be made directly by soldering wires on to the existing pc board. Veroboard can be used to house the extra components.

The alarm should have a ten second delay before the horn or siren begins to sound.

Motorola speaker filter



Phillip Denniss of Chippendale NSW has designed a circuit to smooth the lower cut-off point of Motorola Piezo Ceramic speakers, in particular, the 3½" Super Horn (models KSN 1001A, 1005A, 1032A and 1003A).

Although they are rugged, very efficient and reasonably cheap, they suffer from a fairly high, lower cut-off point at about 4 kHz with a very savage cut-off slope of approximately 20 dB/octave. The proposed circuit smooths out the fast cut-off at the expense of sensitivity. However, the loss of sensitivity is not really a problem since the drivers are very efficient.

The circuit is a two stage filter made from resistors and capacitors only. No inductors are used which makes the circuit attractive, and the input impedance is still quite high, preserving the 'no load' effect of the driver.

The idea was to reduce the cut-off slope to about 6 dB/octave for as long as possible without undue loss of sensitivity. Therefore the 3 dB of the filter was chosen at about 2 kHz. This determines where the roll-off resumes its rapid plunge. The second half of the filter has a step response, where roll-off starts at about 1 kHz and levels out again around 4.5 kHz.

The capacitive load presented by the tweeter (150n) is quite handy, and I use it as part of the filter. It also allows the use of filter sections that are basically non interactive, which simplifies design and implementation.

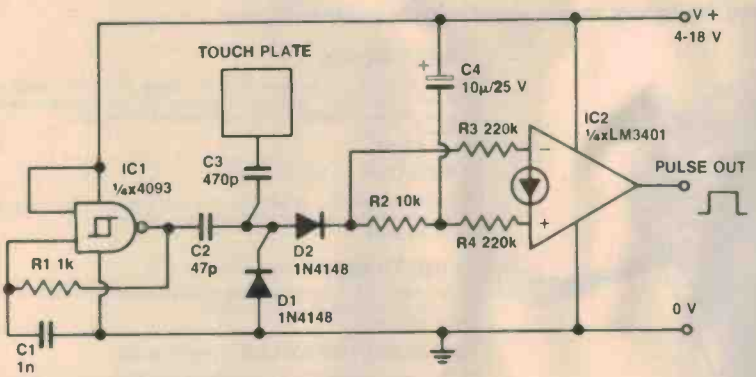
The circuit was originally used with Magnavox 8-30 bass drivers as a stop gap measure.

The filter significantly cuts back the harshness of the tweeter since its broadens the response, although I did find it necessary to use a little treble boost to add some brilliance. I had hoped that the staggered roll-off points would smooth the response without too much attenuation, since the signal to the tweeter is basically reduced by the same factor as the roll-off point.

By including a resistor of 20-30 ohms in series with the 1µ capacitor, the first section of the filter can be altered to give a step response similar to the second section.

Well it's worth trying and the only really expensive part is the tweeter.

IDEA OF THE MONTH



Wide range touch switch ☆★☆

Steven Sims, St Peters NSW.

Most capacitive touch switch circuits use a comparator, where the reference input must be trimmed, and retrimmed if the supply voltage is changed.

I wanted to avoid this as I wished to use the switches in a logic designer, with the supply variable over the CMOS range.

The resulting circuit needs no adjustment and operates happily over the range 4-18 V (the lower limit of the op amp to the upper limit of the Schmitt trigger).

The output of the Schmitt trigger astable IC1, R1 and C1, is fed to the capacitive divider C2 C3, rectified and then sent to both inputs of the Norton op amp comparator. The capacitive divider principle is well known and previously published. However, the way it is employed in this circuit is my own idea.

R2 biases the non-inverting input just below the inverting input, thus the output is normally low. When the plate is touched, the resulting drop in voltage is sent to both inputs, but in the case of the non-inverting input it is delayed by R2 C4. Thus the inverting input momentarily goes below the non-inverting input, turning the op amp on for that time and producing a short positive pulse at the output.

The op amp swings over virtually the entire supply range, resulting in a reasonably clean pulse with no switch bounce. This pulse may be used as a trigger for a monostable; or sent to a Schmitt trigger for squaring up; or sent to an op amp or JK flip-flop toggling circuit; or any other controlling function.

A LM3900 can be used instead of the LM3401. As both the op amp and the Schmitt trigger come in quad packages, the circuit is ideal for banks of four switches.

Dewatering fluid test device

This test setup was constructed by **L. W. Brown of Burwood Victoria** to compare assorted cans of electrical (dewatering) spray.

The device is a 25 mm square of single-sided epoxy, glass fibre, copper laminate with a single, deep knife scratch across the middle.

A multimeter capable of measuring above one megohm was used to detect the presence of moisture.

A can of instant freeze (canned cold) is sprayed across the scratch to clean the board and then condense moisture from the atmosphere. Once the ice on the board has melted it will provide a leakage path of around one megohm.

Finally the de-watering fluid under test is used to remove this moisture; the results are alarming!

'IDEA OF THE MONTH' CONTEST

PRIZE WORTH $90!

COUPON

Cut and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea in ETI Magazine or other publications produced by it. I declare that the attached idea is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

Title of idea .....

Signature .....

Name .....

Date .....

Address .....

..... **Postcode** .....

Scope Panavise Multi-Purpose Work Centre.

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Panavise Multi-Purpose Work Centre, Model 376/300/312, comprising a self-centering head (376), standard base (300) and tray base mount (312), all worth about $90! Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each winner will be paid $10 for the item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked prior to and including the date of the last day of the month.

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

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FROM $39.95 *

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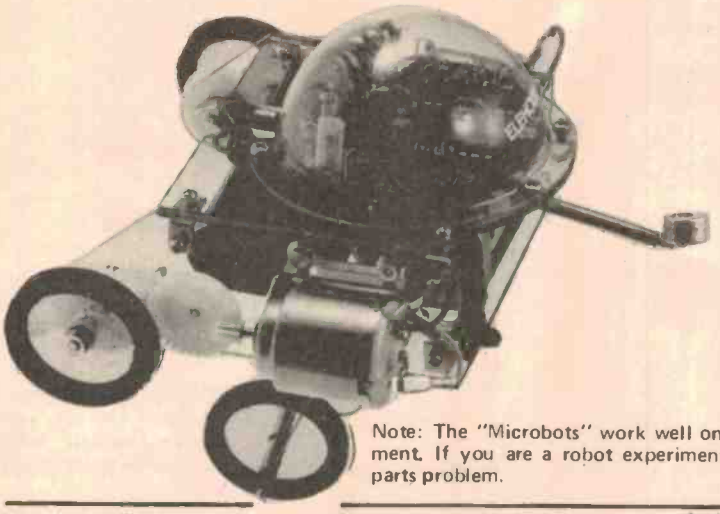
The units feature solderless connections with explicit illustrations to ease assembly. Only simple tools (i.e. screwdriver, pliers etc.) are needed to assemble.



PIPER MOUSE

This "microbot" is powered by 2 DC motors that drive wheels. When a special ultrasonic whistle is blown, the unit goes left, right, straight ahead according to your command. Complete, including perspex dome cover!
Be a Pied Piper!
Cat. KJ-6680 ONLY $39.95

AVOIDER (not illustrated)

Similar to the Piper Mouse, but this unit travels on its own. It avoids objects because it has an infra-red beam system. Very clever!
Cat. KJ-6682 $44.95

LINE TRACER (not illustrated)

This robot will automatically follow a black line drawn onto a sheet of paper. It uses an infra-red feed back system.
Cat. KJ-6684 $39.95

MEMOCON CRAWLER (not illustrated)

This robot is controlled by a keyboard which is supplied. The operation of the unit is programmed by the keyboard and stored in RAM. All movements can be controlled as well by lights (beams) and sound (buzzer).
A very sophisticated unit.
Cat. KJ-6686 $79.95

Note: The "Microbots" work well on their own but can also be used as a platform for robotic development. If you are a robot experimenter you will find them useful as they help resolve the mechanical parts problem.

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- Less than 0.1% distortion
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Back at last! No hassle amplifiers. Just connect a transformer, speakers a signal and you're away!

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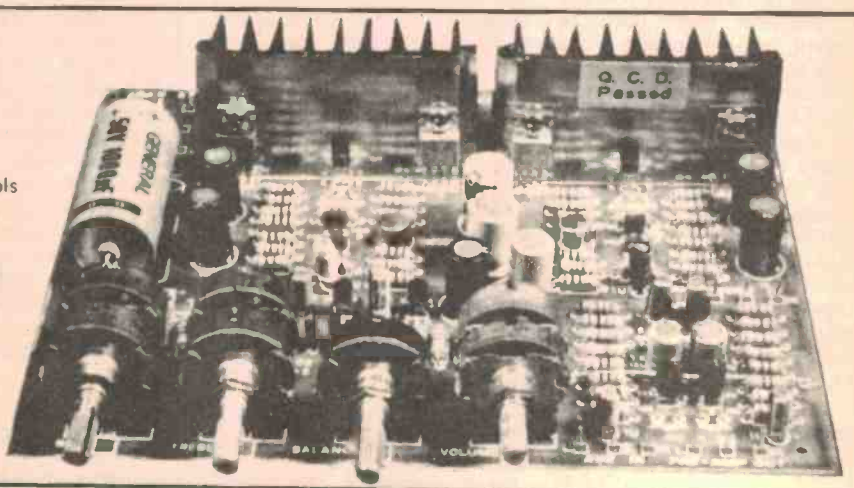


minitune

Ref: EA June 1983

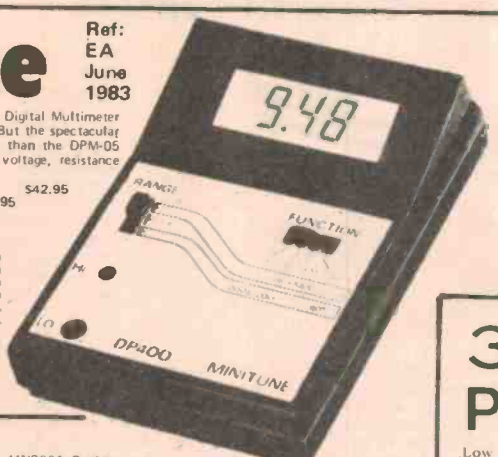
Following the spectacular success of the DP2010 Digital Multimeter kit, we now have an ENGINE ANALYSER KIT! But the spectacular thing is the price! It is ACTUALLY CHEAPER than the DPM-05 Display and Case!! The Minitune will measure voltage, resistance (down to a very low range), RPM and Dwell Angle.
Cat. KJ-7012 $42.95

TEST LEADS TO SUIT ONLY $2.95

Specification

Function	F.S.D.	Resolution	Accuracy
Voltage (d.c.)	20V	10mV	0.5% ± 1 digit
	200V	100mV	0.5% ± 1 digit
Resistance	2000Ω	100mΩ	0.5% ± 1 digit
	20kΩ	10Ω	0.5% ± 1 digit
R.P.M.	20,000r.p.m.	10r.p.m.	1% ± 3 digits
Dwell	90°	0.1°	2% ± 3 digits

$42.95



NEW ETI JOYSTICK CONTROLLER

Ref: ETI Dec. '83
True proportional control with this kit. Includes recommended joystick unit.

ONLY $24.95

BBD EFFECTS BOX

Fantastic low cost instrument using the versatile MN3001 Bucket-Brigade Delay Line to achieve brilliant sonic effects. Now you can emulate the commercial rock groups with Phasing, Flanging' Reverb and Echo. The Jaycar kit includes all components INCLUDING IC sockets and the TU-04 box. (Not cut down but this is easily done). Jaycar has a specially built cabinet for this kit with all holes pre-punched etc., at only $10 extra but only if you buy the original kit from us. Available as a separate item for $29.50. WHEN THE KIT IS PURCHASED WITH THE DE-LUXE CASE THE TU-04 CASE WILL NOT BE SUPPLIED.

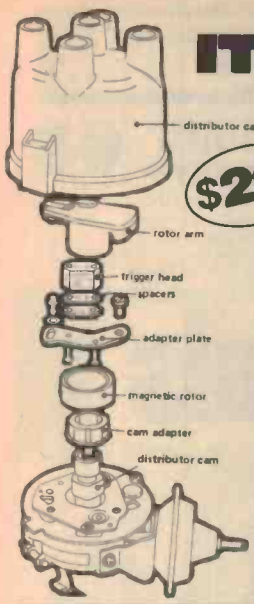
Special cabinet to suit Cat. HB-6445 $10
Complete Kit Cat. KE-1522 ONLY $79

3½ DIGITAL PANEL METER (not illustrated)

Low cost unit. Completely self-contained. No longer an expensive proposition! This easy-to-build kit (takes about 1 hour) is self-contained, compact and even comes with a front panel filter/bezel. It can be battery 6V or DC powered.

- 200mV. Full scale (+/– 199.9mV)
- Input impedance 10 to the twelvth ohms
- Required DC 5-6V @ 150mA
- Guaranteed to reset to zero at zero input voltage
- Automatic reverse polarity indication
- Assembly instructions include notes on using your DPM for: Amp-meter, AC-Voltmter, Anmeter, Thermometer, Frequency Counter, Capacitance Meter (circuits supplied)

STAGGERING VALUE
Cat. KJ-6670 $29.95



IT HAD TO HAPPEN

With this kit and the interface electronics you can forget about contact breaker point problems!
Cat. KJ-6655 $29.95

$29.95

New PCB for TAI Kit includes Hall Effect interface. Cat. HP-8786 ONLY $3.95

PLEASE NOTE
this system must be used in conjunction with an electronic ignition. The Hall Effect device will not switch enough current to replace the contact breaker points on their own!

A professionally-engineered electronic ("breakerless") contact breaker system.
Yes, only Jaycar has a complete Hall-effect triggerhead assembly designed to adapt to an extensive number of cars. Each kit contains the following:
- HALL EFFECT TRIGGER HEAD
- MAGNETIC ROTORS FOR BOTH 4 & 6 CYLINDER CARS
  OVER 6 CAM LOBE ADAPTORS
  OVER A DOZEN DIFFERENT ADAPTOR PLATES FOR YOUR PARTICULAR DISTRIBUTOR
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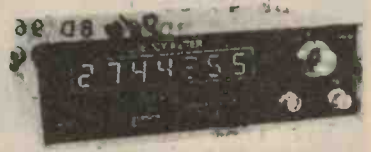
- AS EASY TO INSTALL AS A SET OF POINTS!
- INSTRUCTIONS (SIMPLE-TO-FOLLOW) INCLUDED!

This set is designed to fit most European and Japanese cars. In fact it will also fit many Australian cars fitted with Lucas, Bosch, Motorcraft, AC Delco or Autolite electrics. If you wish to check first, please send SAE for car/distributor list.
Because we have no way of knowing, you get the fitting set for ALL of the distributors available. Basically you end up with a jar full of parts that you don't need to use! (Perhaps for your next car?)
Quite frankly, we are amazed that we can supply such a comprehensive kit for this price. To produce a kit that will adapt to the dozens of different distributors around is amazing!
Remember, once you have installed a breakerless system it will never wear out and that part of your system will remain in tune FOR EVER.
We expect this kit to sell well. To ensure that you receive one, check with us early!
Cat. KJ6655

Jaycar will not be knowingly undersold FOR GOODS OF THE SAME QUALITY. If you find that a competitor is cheaper, get all the facts and tell us! If you are right we will match OR LOWER his price!
Please understand that we cannot match the price of goods that are NOT the same quality as ours.

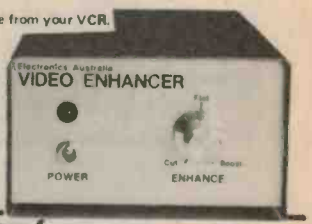
500MHz DFM

Ref: EA Dec '81 – Feb '82
Jaycar has by far the best kit version of this project in Australia. We now supply 2 x GOLD plated BNC input connectors at no extra cost!
KA-1390 (50MHz) $129
KA-1392 (500MHz option) $20



VIDEO ENHANCER

Ref: EA Oct 1983
Get improved performance from your VCR.
Cat. KE-7016

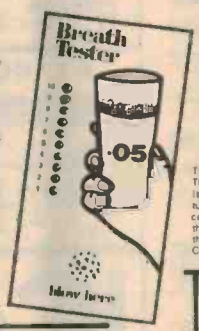


Breath Tester

$35

In all states and territories in Australia it is an offence to drive a vehicle with an alcohol/blood concentration above a certain limit. In most states it's 0.05 others 0.08. Either way it's only a relatively small number of alcoholic drinks.
Because it's only a small number of drinks, many people (quite wrongly) believe that they remain below the statutory limit.
The KA1522 Breath Tester can help here. A unit with the same circuit diagram was featured in May "Electronics Australia". It CANNOT give you an actual blood/alcohol content reading, however it can go close. And it can give you a relative reading between inebriated friends!!! Great at parties!!!
Grab the whole kit now for only $29.95. You never know, it may save your licence or your life!

ONLY $29.95



Video Amplifier/Buffer

Ref: EA Aug 1983

The answer to a mardens prayer!
This device can be made to fit inside a TV set (or in a separate box if necessary). It basically enables you to connect straight into the video drive of your TV, turning it into a colour monitor. This means that the video signal from your computer, VCR, TV game etc. does not need to be converted to RF and go through the TV IF strip. You will be amazed by the clearer, sharper signal that has less interference! Notes on how to fit to various TV sets are included.
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Jiffy Box to suit HB-6003 $2.20

INFRA RED DIMMER KIT

$25.95

Ref: EA January 1984
Now you can dim or turn off the lights from the comfort of your armchair!
Short form kit contains all parts for I.R. kit. Note this must be used with a Jaycar KA-1509 Touch Sensitive Dimmer ($19.95)
Cat. KA-1530 $25.95

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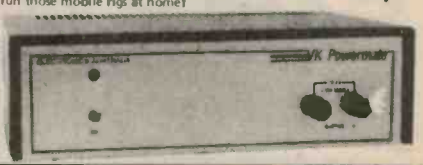
Ref: EA Dec. '82
Get up to 13.8V @ 10 amps to run those mobile rigs at home!
The Jaycar kit is complete.
$89.95 comp

$89.95



50V/5A laboratory power supply

Ref: EA May/June 1983
Cat. KE-1520
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ETI 644

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Ref: ETI
October 1982

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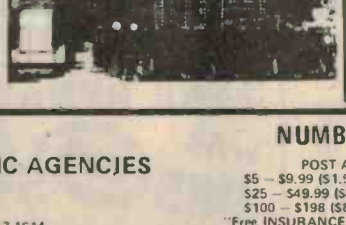

VIDEO SENSATION AT LAST

A Video Enhancer/ Distribution Amplifie designed EXCLUSIVELY for AUSTRALIA

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BUILT, TESTED AND GUARANTEED

Jaycar has had designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL-D system.
As far as we know it is the ONLY Australian designed, Australian built unit available!!
But, guess what? The Jaycar AV6501 Enhancer is CHEAPER than its inferior imported Asian counterparts!!
This unit is professionally designed and University tested! It works and it works well.

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DO-IT-YOURSELF AND SAVE.

$39 Pair

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Power Transformers 1/2 PRICE

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AUST. MADE, AT HALF NORMAL PRICE

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		0-20V, 1A
B	0-120, 0-110-130	0-25V, 5A
	PRICE $15.00	0-20V, 1A
		0-110V, 200mA
C	0-110, 0-110-130	0-24V, 1A
	PRICE $10.00	0-24-28-30V 1Amp
D	0-110, 0-110-130	0-22-24V 2A
	PRICE $10.00	0-27V, 1A
		0-12V, 1A
E	0-240	0-18V, 400mA
		17.5-0-17.5-60-180
	PRICE $8.00	-300V, 100mA
F	0-240	0-18V, 2A
	PRICE $7.00	0-8.5V, 3A
G	0-110-240	0-33V, 1.25A
	PRICE $4.50	
H	0-240	0-12.6V, 1A
	PRICE $4.00	
I	0-240	0-12.6V,
	PRICE $3.50	500mA
J	0-240	20-0-20V
	PRICE $15.00	2 Amps
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L	0-240	0-24V
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1,000's of mfds TESTED and G'TEED

IC's "SWEEPINGS OFF THE FACTORY FLOOR"

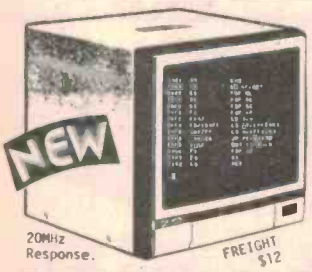
Approx 100 ASST. FOR **$10.00** 1000 for **$90**

LARGEST RANGE AVAILABLE

30,000uF	5v	$ 3.00	44,000uF	30v	$11.00
100,000uF	5v	$ 5.00	60,000uF	30v	$12.00
150,000uF	5v	$ 6.00	100,000uF	30v	$14.00
12,000uF	10v	$ 2.00	15,000uF	35v	$ 6.00
25,000uF	10v	$ 3.00	25,000uF	35v	$ 8.00
29,000uF	10v	$ 3.50	30,000uF	35v	$ 9.00
42,000uF	10v	$ 4.00	7,200uF	40v	$ 4.00
62,000uF	10v	$ 4.75	9,400uF	40v	$ 4.50
76,000uF	10v	$ 5.50	10,000uF	40v	$ 5.00
90,000uF	10v	$ 6.00	12,000uF	40v	$ 6.00
100,000uF	10v	$ 6.50	12,900uF	40v	$ 6.50
150,000uF	10v	$ 6.75	20,000uF	40v	$ 7.50
160,000uF	10v	$ 7.00	21,000uF	40v	$ 8.00
184,000uF	10v	$ 7.50	21,500uF	40v	$ 8.00
200,000uF	10v	$ 8.00	31,000uF	40v	$ 9.00
17,000uF	15v	$ 3.50	32,000uF	40v	$ 9.50
21,000uF	15v	$ 3.75	33,000uF	40v	$10.00
30,000uF	15v	$ 4.00	48,000uF	40v	$12.00
31,000uF	15v	$ 4.25	20,000uF	45v	$ 9.00
34,000uF	15v	$ 4.50	3,500uF	50v	$ 3.00
47,000uF	15v	$ 4.75	4,000uF	50v	$ 3.50
50,000uF	15v	$ 5.00	5,000uF	50v	$ 4.00
51,000uF	15v	$ 5.00	6,000uF	50v	$ 4.50
60,000uF	15v	$ 5.50	7,000uF	50v	$ 5.00
63,000uF	15v	$ 5.50	8,000uF	50v	$ 5.50
73,000uF	15v	$ 6.00	9,000uF	50v	$ 6.00
80,000uF	15v	$ 6.50	12,000uF	50v	$ 8.00
83,000uF	15v	$ 7.00	15,000uF	50v	$ 9.00
140,000uF	15v	$ 8.00	22,000uF	50v	$10.00
16,000uF	16v	$ 4.00	23,200uF	50v	$11.00
68,000uF	16v	$ 8.00	34,800uF	50v	$14.00
10,000uF	20v	$ 3.50	20,000uF	55v	$10.00
25,000uF	20v	$ 6.00	7,800uF	60v	$ 6.00
39,000uF	20v	$ 7.50	20,000uF	60v	$11.00
90,000uF	20v	$10.00	30,000uF	60v	$12.00
7,700uF	25v	$ 3.50	25,000uF	62v	$12.00
10,000uF	25v	$ 4.00	4,500uF	64v	$ 5.00
11,000uF	25v	$ 4.00	9,000uF	75v	$ 8.00
12,000uF	25v	$ 4.50	10,000uF	75v	$ 9.00
13,000uF	25v	$ 5.00	12,800uF	75v	$10.00
14,000uF	25v	$ 5.50	16,800uF	75v	$12.00
18,000uF	25v	$ 6.00	20,000uF	75v	$14.00
19,000uF	25v	$ 6.50	24,000uF	75v	$15.00
25,000uF	25v	$ 7.00	2,800uF	100v	$ 3.50
32,000uF	25v	$ 7.50	6,500uF	100v	$ 9.00
44,000uF	25v	$ 8.00	14,500uF	100v	$13.00
47,000uF	25v	$ 8.50	20,000uF	100v	$15.00
50,000uF	25v	$ 9.00	3,000uF	150v	$ 4.00
55,000uF	25v	$10.00	3,000uF	200v	$ 6.00
12,500uF	30v	$ 5.00	3,300uF	200v	$ 6.50
24,000uF	30v	$ 7.00	4,800uF	200v	$10.00
30,000uF	30v	$ 8.00	5,400uF	200v	$11.00
37,000uF	30v	$ 9.00	5,500uF	200v	$11.50
40,000uF	30v	$10.50	2,900uF	250v	$ 8.50

GREAT VALUE-FOR-MONEY

START YOUR SAVINGS BONANZA NOW!!!



NEW

20MHz Response.

FREIGHT $12

ORANGE SCREEN COMPUTER MONITORS

LIMITED STOCK AT THESE PRICES

ORANGE SCREENS GIVE A CLEAR, HONEST IMAGE! Computer data and graphic displays never looked better, brighter, sharper.

ORANGE SCREENS AREN'T A SIGHT FOR SORE EYE'S! Positive research indicates that orange causes least eye fatigue.

High Resolution 1000 lines at centre resolution. Display characters: 1920 (80x24) **$199** Incl S/Tax

MONEY-BACK OFFER IF NOT FULLY SATISFIED

BRING YOUR OWN COMPUTER FOR A FREE DEMONSTRATION. BANKCARD ORDERS OK

APPLE® 100% COMPATIBLE PRODUCTS

® Trade Mark of Apple

$365 SLIM-LINE DISK DRIVE

WITH READ/WRITE DISK PROTECT SW.! Price does not include disk drive card.

DISK DRIVE CONTROLLER CARD. Plugs into an expansion slot and will run up to 2 disk drives. Limited quantity avail at.. $79

Bring your APPLE for a free in-store demonstration. Bankcard OK.

SPEECH SYNTHESIZER BOARD....UNLIMITED VOCABULARY COMPLETE WITH SPEAKER AND DISK .. $75

PRINTER BOARD ....FOR PARALLEL PRINTERS, .$95

WILD COPY CARD....ULTIMATE DISK BACK-UP .$99

PROTOTYPING BOARD ....DESIGNER'S HELP .. $25

JOYSTICKS ....SELF-CENTERING, ADJUSTABLE .. $40

New 80 Column card, Z80 CPU card, 16K RAM card, PAL Colour card, etc now available.

NEW Products

FROM QT COMPUTER SYSTEMS S100 Specialists!

1 UNIVERSAL FLOPPY DISK CONTROLLER

Suits Super 80, System 80, TRS-80, Microbee or any Z80 based computer. (board fitted with std S100 connector)

- Can operate up to 4 x 8" or 5¼" drives.
- Includes DMA.
- CP/M routines for most popular Z80 systems.
- Uses WD2793 Controller

2 S100 VIDEO BOARD

- 80 x 25 screen format
- Graphics resolution: 225 x 560 dot addressable
- Graphics software available

Please send SAE for further information on any products.

3 FDC-1 SINGLE BOARD COMPUTER

- Z80A 4MHz or Z80B 8MHz option
- 2 Serial ports avail.
- 2 Parallel ports avail.
- NEC765 Floppy Disk controller
- Up to 8K RAM or ROM

Just add memory and you have a complete system - easy upgrade to multi user operation.

SPECIAL OFFER!

256K DYNAMIC RAM

WAS $995 NOW **$695**

NOW SAVE A MASSIVE $300

NEW, LOWER PRICE INCLUDES M-DRIVE OR CACHE Q SOFTWARE SUPPLIED FOR SYSTEM IMPROVEMENT

- 16K to 256K bytes; uses 4116 or 4516 or 4164 memory devices.
- Guaranteed to operate at 4MHz with no wait states (6MHz: 1 wait).
- Adjustable timing allows operation with Z80, 8080, 8085 micros.
- Can be divided into max. 16 banks, each variable in 4K add-ons.
- Each 4K segment can be individually enabled or disabled easily.
- Each bank can be located on any 4K boundary.

PRE-PAK electronics p/l | **1a WEST ST, LEWISHAM, NSW** | **569-9797** 24 HR PHONE ORDER SERVICE | **Phone or mail order BANKCARD accepted**

GO ANYWHERE 12-240V POWER

MASSIVE 300 WATTS

These great inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.
MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.
ALTRONICS' KIT features ☆ Gold plated edge connector and PCB buss ☆ Low age rate XTAL ☆ Sockets for all IC's ☆ High Efficiency Transformer.

K6750..... (EA JUNE '82) ... **$199.50**

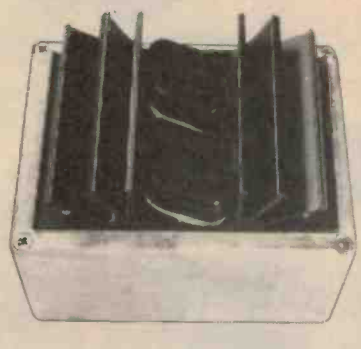
($10 DELIVERY AUSTRALIA WIDE)

40 WATT MODELS

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.
EASY CONSTRUCTION ☆ VALUE PLUS

K6700..... **$55.00**

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



The Altronics kit includes all components for the modifications, detailed by Electronics Australia Feb. 1983.
Yes, it's bad enough paying $2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. Easy to build!

K4010..... **$35.00**

★ KIT SUPPORT FOR THE MICROBEE ★

MULTIPROM INTERFACE

44K OF PROGRAM STORAGE

A sensational new kit for the MICROBEE, requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

The Altronics Kit comes complete in every way
* Full set of IC sockets.
* Double sided, plated through board.
* Assembled connection lead to Microbee.
* Fully documented.
* Cassette monitor included (plus sourcefile).

THE MICROBEE KIT OF 1983

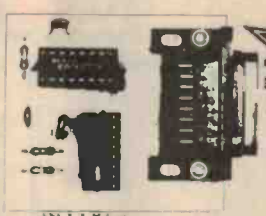
K9673..... **$99.50**

PARALLEL INTERFACE

BUILD YOUR OWN INTERFACE AND SAVE $$$

A simple kit to build — takes about 20 minutes, save on the cost of a built interface and save the cost of a serial printer.

K9671..... **$29.95**



INCLUDES CENTRONICS PLUG AND CABLE

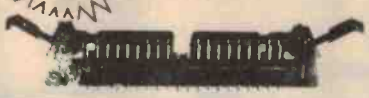
PROPORTIONAL JOYSTICK

K9674
$32.50
(ETI DEC '83)

AT LAST AN ANALOGUE JOYSTICK
Plot X-Y co-ordinates on the screen, sign your name. A great graphics aid. Complete kit **including case**, software example.

PRICE BREAK-THROUGH

50 PIN EXPANSION SOCKETS



Right angle type to suit Microbee, floppy disk controllers etc.
Mounts on PCB and mates with IDC sockets.

D1196... **$8.50** EA... 10 + ... **$7.50**

EPROM PROGRAMMER

(ETI JAN '83)

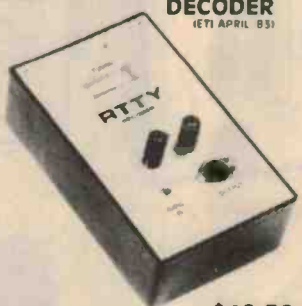
K9668..... **$55.00**

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.
KIT FEATURES Sockets for all other IC's. 1 x 2716 supplied — get started straight away. Front Panel and Mains (SEC approved) transformer. 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket included. DB 15 Plug. Complete to last nut and bolt.

(See Review ETI AUGUST 1983)

RADIOTELETYPE DECODER

(ETI APRIL '83)



K9733..... **$19.50**

Display RTTY encoded messages on your video Monitor. Receive up to date weather information, international News before the Papers, all sorts of coded military info. Simple circuit uses PLL techniques. Single PCB Construction. Kit includes DB15 Plug and backshell for connection to microbee. Shielded pretinned PCB.

MICROBEE LIGHT PEN

NEW

(ETI AUGUST '83)

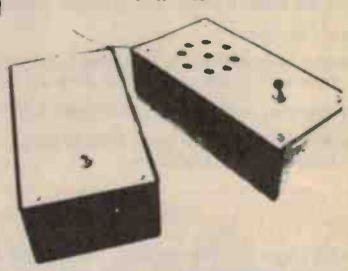
PROVIDES DIRECT PERSONAL CONTACT WITH YOUR BEE!

K9649 **$19.95**

AT LAST ... a light pen for the Bee. This pen works in the low resolution graphics mode and connects directly to the I/O port. • Complete kit including DB15 2m CORD. • Fully documented with software example.

FAX-DECODER

(ETI SEPT '83)



K9733..... **$24.50**

This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satellite pictures etc. and then reproduce them on your dot matrix printer.
• Complete kit of parts includes DB15 Ribbon Cable
• SOFTWARE LISTING

BOGGLE GOGGLES

$9.60

Short form

PH METER

$139

with probes

Tacho/dwell meter with digital display

MAY EA 1982

$79

12/240 volt Inverter

40 WATTS

MAY EA 1982

$49.50

$48.50

Engine Analyser Kit

Eprom Programmer

$55.00

JANUARY EA 1982 INCLUDES TEXTOOL SOCKET

REMOTE INFRARED TV SOUND CONTROL

$40

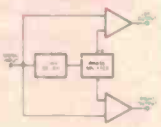
E.A. JANUARY "93".

Designed to relieve the long-suffering TV viewer from painful, brain-killing advertisements, our TV Sound Control provides remote control of volume. It gives eight steps of control, including full off, when total silence is called for. Give yourself a break and relieve advertising tedium today.

$55.00

STEREO SYNTHESISER FOR TUNERS AND VCRs

Enjoy the benefits of stereo sound from your video cassette recorder, TV or AM tuner with this Stereo Synthesiser. The circuit uses just four ICs and is easy to build.



OVER 200 NOW SOLD

EA INVERTER INCLUDING TRANSFORMER 300 WATTS

$195

P & P $10.00 Anywhere in Australia

JUNE EA 1982

SPECIFICATIONS FOR 300W INVERTER

Nominal Supply Voltage	12V DC
Output voltage	see table
Frequency	50Hz ± .005%
Regulation	see table
Maximum Load	300VA
Current Limiting	30A (primary)
Efficiency	see table

Resistive load W	Output voltage (RMS)	Input current (A)	Efficiency (%)	Battery life 40Ah/20h rate (minutes)
no load	210	1.2	0	–
40	235	4.5	60	240
100	240	11.3	62	80
140	240	15.0	69	60
200	240	20.1	78	50
240	240	24.0	79	32
300	235	29.6	82	28

$189.00

Analogue and Digital Storage CRO Kit

EA DIGITAL READOUT FOR SW RECIEVERS

$72.00 COMPLETE

OCTOBER EA 1982

Want to add digital frequency readout to an AM radio or shortwave communications receiver that uses an old-fashioned analog dial? This unit features a bright four-digit LED display, 1kHz resolution, and a 0.2s update time that's fast enough to follow the tuning knob.

SPECIFICATIONS

Ranges (full scale): 0-10MHz and 10-30MHz (optional).

Display: Four digit

Resolution: 1kHz with division switch set to divide by one; 10kHz with division switch set to divide by 10.

Sensitivity: Less than 100mV from 500kHz to 30MHz.

Offset frequency: Prototype set to 455kHz, but any offset frequency can be programmed.

EA EASY-TO-BUILD FREEZER ALARM

$21

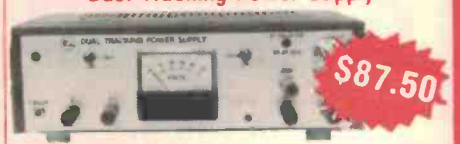
OCTOBER EA 1982

EA THEREMIN

$34.50

JUNE EA 1982

Duel Tracking Power Supply



$87.50

100w Sub-Woofer Amplifier

$85.00

JULY EA 1982

PLUG PACK REGULATOR

$14

Plugpack Extra

EA ELECTRONIC STARTER FOR FLUORESCENT LAMPS

$5

OCTOBER EA 1982

ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A'Beckett St., Melb., Vic.
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436
Mail orders to P.O. Box 235 Northcote 3070 Vic.
Minimum P & P $3.00. Errors & omissions excepted.
Please address tax exempt, school, wholesale, and dealer enquiries to:
RITRONICS WHOLESALE
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923 Telex AA 38897

SHOP AROUND

This page is to assist readers in the continual search for components, kits, printed circuit boards and other parts for ETI projects and circuits. If you are looking for a particular item or project and it is not mentioned here, check with our advertisers.

ETI-675 serial-parallel interface

It's a fact of life that computer peripherals, like printers, are available cheapest with a parallel interface but computers themselves generally have their output handling routines configured for serial operation. Inevitably, you want a printer, but balk at paying the extra $100+ for the serial interface version. Well, now you can buy a printer at the best price (parallel interface) and still enjoy the convenience of your computer's serial output handling routines. Build this project!

The project is based on a UART made by General Instruments, the AY-3-1015D, distributed in Australia by **Daneva** of Melbourne. This chip has a number of features Geoff Nicholls took advantage of. It is fully double buffered, supports full duplex operation and can handle multiple baud rates, has tri-state outputs and only requires a single 5 V supply rail. Baud rate is externally selectable. It's got a lot going for it. the AY-3-1015D is the only 'special' component in the whole project, but stocks should be readily obtainable. We purchased one for the prototype from **Avtek** in Sydney.

This project will doubtless get wide support from kit suppliers, so you should have little difficulty. Initially, try **Altronics** in Perth, **Avtek** in Sydney and **Rod Irving Electronics** in Melbourne.

Components for the project should be readily available. If you want ready-made pc boards, then try Jaetronics in Melbourne, Jemal in Perth, Better PC Boards in Sydney or Mini Tech in New Zealand.

If you want to make your own pc board, then film positive or negative can be obtained from'ETI-675 Artwork', ETI Magazine, P.O. Box 227, Waterloo NSW 2017, for the princely sum of just $4.00, post paid.

ETI-656 bug debugger

If you're right into micros and micro systems, devising your own software and generating your own 'firmware' in EPROMs, then this project will get you out of difficulties when your new firmware stubbornly refuses to behave!

You should not have too much difficulty obtaining the components, but you may need to shop around a little to find the 6117 RAM chip.

Low insertion pressure sockets are much cheaper than zero insertion force (ZIF) sockets, but you might like the luxury of the latter for SK1 — the PROM socket on-board. Either type should not be difficult to source.

If you're using battery back-up, the 3 V NiCad might take a little searching out. One place to try is **Powersonic, 100-102 Buckingham St, Surry Hills 2010 NSW; (02)699-2722.**

If you're making your own pc board and Scotchcal label, film positive or negative artwork can be obtained for just $2.60, post paid, from 'ETI-656 Artwork', ETI Magazine, P.O. Box 227, Waterloo 2017 NSW.

ETI-273 let caller

Give the umpire a serve! Build our let caller. Constructors should have little difficulty sourcing components for this one. The sensor coil is actually a reed relay coil and most electronics suppliers stock this item. As a point of reference, the one used in the prototype came from **Dick Smith Electronics** and is known as cat. no. S-1948. It costs just $1. The box is a standard small (UB5) 'zippy' box. The piezoelectric buzzer used on the prototype was made by Murata and is distributed here by **IRH** in Sydney. Many types of piezo buzzer can be used — just make sure you get one that's loud enough for you. **Tandy** stores stock a whole range. Try their "super-loud" piezo buzzer, cat. no. 270-060, for example. The Richco KLB-350A curly-clip is distributed by **Mayer Krieg** (Sydney and Adelaide). **Rod Irving Electronics** will be stocking kits, and you might also try **All Electronic Components** — both in Melbourne.

If you want to make your own pc board and Scotchcal front panel, combined artwork can be obtained for just $2.40, post paid, from 'ETI-273 Artwork', ETI Magazine, P.O. Box 227, Waterloo NSW 2017.

ETI-166 function-pulse generator

We've had numerous 'phone calls from readers enquiring as to where a kit for this popular project could be obtained. Well, we're happy to report **Altronics** will be supplying them from next month. You can order by 'phone for the cost of a local call as they have an INWATTS line. The number is 008-999-007. The kit will include everything, including the things we didn't think of, according to Kevin Thompson, Altronics' Kit Manager. That should save you the hassle of running around trying to buy all the bits yourself.

Printed circuit boards

Almost every pc board (and most front panels) ever published by ETI may be obtained from:

All Electronics Components
118 Lonsdale St
Melbourne Vic 3000

For pc boards produced in recent years, the following suppliers either keep stocks on hand or can supply to order:

Jemal Products
P.O. Box 168
Victorla Park WA 6100

Jaetronics
58 Appian Drive
St Albans Vic 3021

Better PC Boards
112 Robertson Rd
Bass Hill NSW 2197

Mini Tech
P.O. Box 9194
Auckland N.Z.

the following retailers generally keep stocks on-hand of pc boards from recent years' ETIs:

Rod Irving Electronics
425 High St
Northcote Vic 3070

Billco Electronics
Shop 2, 31 Pultney St
Dandenong Vic 2175

Jaycar
117 York St
Sydney NSW 2000

STC CHAIRMAN WINS WORLD COMMUNICATIONS YEAR AWARD

Mr Allen Deegan, Chairman and Managing Director of Standard Telephones & Cables Pty. Limited, has won the prestige World Communications Year Award.

The award, sponsored by the Federal Department of Communications and the Overseas Telecommunications Commission (OTC), is for the Australian who has furthered the influence of communications on Australian life.

Mr Deegan, 59, of Sydney, is also President of the Australian Electronics Industry Association, which represents 40 of the nation's leading companies in the telecommunications and electronics field. He is a Vice-president of the NSW Branch of the Metal Trades Industry Association and a member of the Electronics Advisory Council.

He is also Chairman of STC-Cannon Components, Austral Standard Cables and Bly's Industries, and a Director of Standard Telephones & Cables (New Zealand), International Telephone and Telegraph Corporation (ITT) New Zealand and the Australia-New Zealand Businessmen's Council.

Nominees for the award, to mark World Communications Year, were received from both the technical side of the industry and from those who have shown leadership in putting communications into use.

Me Deegan joined STC at the age of 15. He served with the RAAF during the War in the electronics branch and returned to STC in 1945, rising through the ranks to become Managing Director in 1970 and Chairman of the Board seven years later.

His visionary attitude in initiating and guiding many developments involving communications, has made STC a leader in high technology. These developments include the establishment of a new $10 million factory at Liverpool for the manufacture of undersea electronics repeaters for the Sydney to Vancouver ANZCAN communication cable and sophisticated harness cable equipment for Aussat and other satellites for export overseas.

The judging panel for the award was the OTC General Manager, W. T. Schmidt; secretary of the Department of Communications, R. B. Lansdown and former ABC chairman. Dame Leonie Kramer.

MARINE RADIO HANDBOOK

The boating industry is booming, despite the harsh economic climate. Unfortunately, more people are getting into trouble on the water, something authorities believe could be avoided in many cases if communications on the water were improved.

However, there is still considerable confusion surrounding the essentials of marine radio. Dick Smith's new book, 'Australian Marine Radio Handbook' is designed to help answer many questions about marine radio. Questions covered include; what is marine radio? Which one is right for me? What about licences, antennas, installation, correct procedures and frequencies?

The book is edited by Tony Clegg, an authority on Australian marine radio who states, "If just one life is saved, the book will have achieved its purpose."

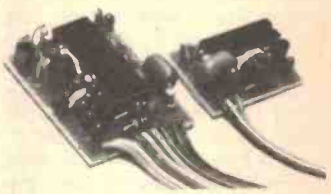
The 'Australian Marine Radio Handbook' is listed in Dick Smith's catalogue as No. B-9604 and retails for $12.95. In addition to Dick Smith stores, the book is also available from newsagents.

ENCODER/DECODER SUITS 'MANDATORY QUIET BASE'

Signalling Technology has released two new Australian-made continuous-tone coded squelch (CTCSS) modules, as sub-audio control signalling elements in VHF/UHF portable and mobile radio equipment.

Under the Federal Department of Communications' new policy, it is mandatory for all new systems to have a quiet base-station facility.

The CTCSS modules enable quiet base/quiet mobile operation, eliminating annoying chatter and interference by other channel uses. Key features are their small size and ease of installation, making them suitable for virtually all types of radio communications equipment.



For further information, contact **Signalling Technology, 2 Apsley Place, Seaford Vic. 3198. (03)786-0077.**

INTERFERENCE FROM CORDLESS TELEPHONES

Unapproved cordless telephones being sold to residents and businesses were causing serious interference to telecommunications in the Gold Coast area, said a spokesman for the Department of Communciations.

The spokesman said that many of the users might not be aware that they were operating illegal equipment because in many cases false approval stickers had been attached.

Apparently this warning had become necessary following the receipt of numerous complaints recently of serious interference to television reception and to other radiocommunications services, caused by the use of unapproved equipment of this type.

People requiring further information should ring Mr **Boyd Rayment, Department of Communications, (07)52-8822,** or write to the **State Manager, Radio Frequency Management Division, Department of Communications, Aviation House, Cnr Wickham and Ballow Streets, Fortitude Valley Qld 4006.**

MOTOROLA'S 'EXPO' HANDHELD REDUCES SIZE AND WEIGHT

Motorola Australia Pty. Limited announced its new "Expo" series portable radio claiming it provides a "dramatic breakthrough" in size and weight.

Two-way portable radios are indispensable to many segments of business, industry, public utilities, police and firefighters plus many other people who are frequently on foot . . . on-the-go and need to communicate.

In addition to the demand for dependable two-way portable radio performance by these users, there has always been a need for a radio that is not only compact in size, but light weight as well, providing ultimate carrying convenience.

Motorola has turned these requirements into reality . . . thanks to years of experience, combined with advanced technology and a new generation of microelectronics, they say.

Only 224.53 cm^3 in volume and 358 g in weight, Expo is the smallest and lightest handie-talkie Motorola has ever built!

The Expo series portable radio meets a variety of severe environmental tests established by US Military Standard 810C, plus Motorola's own unique stringent Accelerated Life Test.

For optimum protection if you work in or near a wet environment, certain Expo models have been designed, tested, and built to withstand complete submersion in up to three feet of fresh water for two hours.

A long list of options and unique accessories are available with the Expo series radio such as . . . *private-line and digital private line* coded squelch protection to reduce co-channel message reception and Quick-call II for the benefits of portable and paging communicatings in one small package.

The remote radio adaptor allows it to operate as a remote speaker microphone with antenna for both improved audio reception and RF radiation.

Additional information about Motorola's Expo series FM portable radio is available from **Motorola Australia Pty. Limited, 666 Wellington Rd, Mulgrave Vic. 3170. (03)561-3555.**

BROADBAND HF ANTENNA

Antenna Engineering Australia's new broadband HF antenna, the Model 4104B, needs only a 15-metre pole, mast, tree or building for support.

It also does not require any adjustment, or special antenna tuning unit, as it is broadband over its full operating range of 2 MHz to 14 MHz.

Suited to the low-power (400 W PEP) SSB HF transceivers, the Model 4104B needs only 20 metres between the main support and the low stub mast. The antenna comes complete with a halyard and pulley for attachment to a support structure.

The radiation pattern of the antenna is basically omni-directional, and it is suitable for communications over distances up to 1000 kilometres.

For further details, contact **Antenna Engineering Australia, P.O. Box 191, Croydon Vic. 3136. (03)728-1777.**

27 MHz CB BASE ANTENNAS

Imark has released three new base antennas for use by 27 MHz CB radio operators.

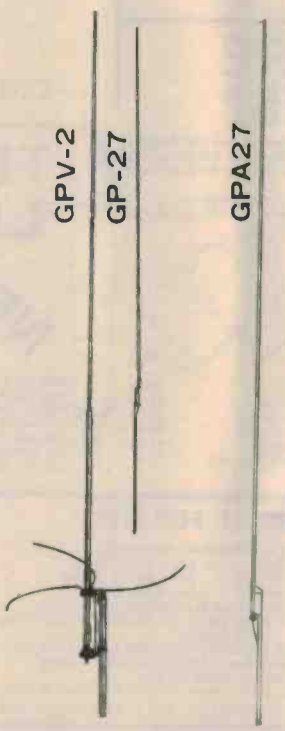
The Hoxin GP-27 is a 5/8-wave antenna, 6.48 metres high and has a gain of 4.2 dB. Three radials are included, and no VSWR adjustment is necessary.

The Hoxin GPA-27 is a half-wave antenna, 5.4 metres high with 3.4 dB of gain. No radials are used and no VSWR adjustment is necessary. It is described as a simple, efficient antenna with the least wind-load area.

The Hoxin GPV-2 is another half-wave antenna, 5.4 metres high and with a gain of 3.4 dB. It has three short radials and features a pi-VSWR matching system.

The Hoxin antennas, which are made in Japan, feature aluminium construction. All tubes are 'deburred' to prevent seizing during assembly.

Further details can be obtained from **Imark, 167 Roden Street, West Melbourne Vic 3003. (03)329-5433.**



COMPUTERISED RADIO DESPATCH SYSTEM

Omnitronics has announced the release of the DL800 computerized vehicle despatch system.

Developed in conjunction with the West Australian Police Department, the transmission medium is the existing VHF (or UHF) radio network, the equipment type being irrelevant.

Previous attempts in this area have been hindered by the lack of a visual display unit suitable for the confines of a vehicle. The DL800 uses the latest in LCD technology to present 160 characters of alphanumeric information. A further 640 characters can be stored for later viewing.

Keyboards can be supplied to order — the standard is a 15-function status keypad plus full alphanumeric keyboard. The printer used by the WA police has 40 columns and uses plain paper. This allows clear type at the lowest possible cost.

Omnitronics can provide interfacing to mainframe or minicomputers to allow complete system installation by one company. Although a mainframe or minicomputer allows the DL800 to operate to full advantage, connection to personal computers such as the Tandy Model 3, Apple etc, is quite feasible.

Other features of the DL800 include single, group and all call addressing modes, data encryption, remote equipment disabling should vehicle be stolen and high speed transmission of 1200 baud. PSK.

For further information, contact **Omnitronics, Unit 3, 42 Osborne Place, Stirling WA 6021. (09)445-2633.**

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Cat. DR-6010

SPECIFICATIONS:
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- 3-WAY POWER AC/BATTS/DC (CAR)
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- NARROW BAND FILTER
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SPECIAL INTRODUCTORY PRICE

Quite frankly we are astounded at the quality of this unit. It is one of the smartest looking modern radios around!
Each unit comes with an extensive manual which includes detailed info on Short Wave Listening as well as a comprehensive list of major Short Wave stations, their frequencies and their correspondence address.

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'TRADE' PACKS OF SCREWS & NUTS etc. NEW

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HE-0736	Rubber feet stick-on 12mm Pkt.100	$9.60
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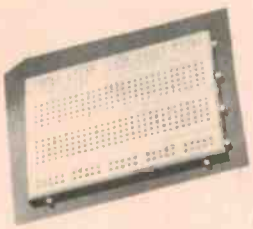
HE-0922	TO-220 Mica insulator kit Pkt.100	$9.80
HP-2742	6BA Flat washer Pkt. 500	$6.95
HP-2752	4BA Flat washer Pkt. 500	$6.95
HS-1521	6BAx½" Cheesehead screw Pkt.500	$7.50
HS-1522	4BAx¼" Cheesehead screw Pkt.500	$5.95
HS-1527	4BAx½" Cheesehead screw Pkt.500	$6.95
HP-2712	6BA Hex nut brass Pkt.500	$12.50
HP-2722	4BA Hex nut brass Pkt.500	$12.50
HS-1607	No.4x¼" Self tapper Pkt.500	$4.50
HS-1609	No.4x½" Self tapper Pkt.500	$5.50

NEW MINI BREADBOARD

Just the right size for many small projects. This board has the same features as our larger breadboards but measures a compact 80mm x 60mm. It has 420 holes.
Perfect for the occasional project

Cat. PB-8808 $6.95



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New low price! This unit, which is similiar to our competitors units offers a huge saving. Why? Direct Import! The unit is not fitted with a connector either because a specific connector limits its use to specific computers. Fit the connector yourself and save a fortune!
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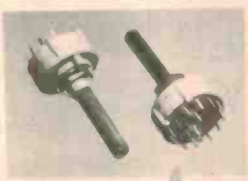
NEW SEALED PCB MOUNT ROTARY SWITCHES



We have decided to discontinue our range of open "skeleton" wafer switches for these. The new switches have contacts enclosed in a fully moulded plastic housing – reminiscent of European design rotaries. The silver-plated contacts are terminated with PCB pins instead of the usual eyelet. You can solder to the pin, of course, but the pin also inserts straight into a PCB. Another feature of the switch is its programability. A removable ring with tab can be inserted into the switch several ways to your particular requirements. For example, if you purchase a 1 x pole 12 way (max) switch you could convert it to, say, 1 pole 7 way between stops. Versatile! Naturally the switches feature 3/8 x 32 TPI bush mount and a ¼" shaft with standard flat. The shaft is hard nylon moulded to help reduce signal capacitance problems.
They are almost the same price as the inferior wafer units.

Cat. No.	Description
SR-1210	1 Pole x 12 way
SR-1212	2 Pole x 6 way
SR-1214	3 Pole x 4 way
SR-1216	4 Pole x 3 way
SR-1218	6 Pole x 2 way

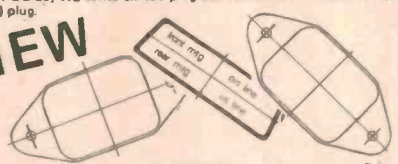
1-9 ONLY $1.95 ea

10+ ONLY $1.75 ea

WHAT ARE STICKIES?

As you can see, "stickies" are stick-on templates. Attach the template to a panel (note the crosshairs for accurate alignment) and proceed to cut out a perfect hole! The plastic film also protects the panel from scratches while you are working on it.
Stickies are available for the common irregular hole cutouts i.e. Cannon DB-25, XL series chassis plug and socket and IEC-320 chassis (mains) plug.

NEW



Cat. No.	DESCRIPTION	Price
NL-4010	25 way 'D' template Pack of 6 templates	$1.95
NL-4014	XLR-31 Series template Pack of 6 templates	$1.95
NL-4018	XLR-32 Series template Pack of 6 templates	$1.95
NL-4020	IEC 320 Chassis plug Pack of 6 templates	$1.95
NL-4024	DIN Chassis socket template Pack of 6 templates	$1.95

TECHNICIANS LIGHT PROBE

NEW $12.95

This NZ made unit enables you to place a spot of bright light in the most awkward places. Ideal for servicemen or kit assemblers. A flashlight or lamp always seems to cast a shadow where you need to see!! The exclusive design allows you to "poke light" around corners!! The unit is solidly made (Aluminium) and takes 2 penlight cells. A two function switch (lock-on and press-on) is also a feature.

Cat. TH-1838 $12.95

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Design of loaded and trap dipoles — using a computer program

This article describes a method of designing simple HF antennas which are self-resonant on one or more frequencies. It includes a computer program (in BASIC) to simplify the calculations involved.

A. P. Boon VK7AW

A SUITABLE ANTENNA is a very necessary companion for any radio transmitter. There are many different types to choose from — multiband, broadband, monoband — to name but a few. An antenna can be self-resonant on the operating frequency or can be teamed with an antenna tuning unit which transforms the antenna impedance to the impedance required by the transmitter (usually 50 ohms resistive). This article describes a method of designing antennae which are self-resonant on one or more frequencies, and includes a computer program to simplify the calculations involved.

The loaded dipole

A dipole antenna which is shorter than a half wavelength can be resonated at a given frequency by adding lumped inductance as shown in Figure 1. Provided that the value of L is chosen correctly, this antenna will behave like a physical halfwave dipole, at the resonant frequency. The direction of maximum radiation is at right angles to the dipole, and the impedance is resistive and about 70 ohms (depending on the height above ground), although the bandwidth for a given VSWR is less than for a full length dipole. Such a configuration often has advantages, especially in restricted-space applications.

For the person who wishes to build such a dipole with a minimum of fuss, it is useful to be able to calculate the values of L, the loading inductance, before constructing the prototype. In an article in *QST*, September 1974, Jerry Hall (K1PLP) published an empirical formula giving the value of L, shown in the panel here.

Figure 1. Loaded dipole.

This is a bit of a mouthful, even if you have a scientific programmable calculator! Subsequently, an article by Dick Sander (K5QY) appeared in *CQ*, December 1981, with a computer program for calculating the value of L for a simple loaded dipole. The program applied the formula directly, substituting wire gauge for diameter.

The main routine of the program described here uses the formula of K1PLP, rearranged for metric dimensions. Additional routines are included to ensure that most of the facilities required for the design of loaded, trapped and loaded-trap dipoles are available in the one program.

Program description

The program is written in BASIC and provides eight options which appear in a menu (lines 200-285). After an option is selected and executed, the user is given the choice of performing further calculations (line 340), returning to the menu if so desired. Some checking of the range of input data is included, but gross errors (e.g: trying to input alphabetical characters in response to a request for a numerical value) will cause the program to halt abruptly.

The first option available calculates the loading inductance required for a dipole which is shorter than a half wavelength at its operating frequency. The input data are *frequency* (MHz), *overall length* (metres), the *distance of the loading coil* from the centre of the dipole (metres) and the *dipole wire* or *tube* diameter (mm).

Intermediate expressions S1 to S5 are used to make the final expression for L (represented by S6 in line 1280) less complex than the original formula.

The second option on the menu calculates the physical length necessary to make a dipole resonant on a given frequency, with loading coils of value L micro-henries at a distance of B metres from the centre. This, in a sense, is the inverse of the first option, and uses an interactive technique to find the resonant length. The assumption is made that the resonant length lies outside the loading coils, but inside a half wavelength.

The initial guess is the average of these two values, and part of option 1 is called as a subroutine to calculate the value of loading required if the antenna were that length. The calculated value of loading is compared with the actual value, and the decision is made as to whether the resonant length is longer or shorter than the initial guess. This process is then repeated, with the interval of uncertainty being halved at every iteration.

The process halts when the calculated inductance for an estimate is within 10 mH of the actual value. Such a scheme may not be an optimum strategy for this particular calculation. However, it is only carried out once, and therefore the processing time is not significant.

Option 3 is a straightforward conversion of inductance into inductive reactance, at a given frequency. The inclusion of this function makes life a little easier in the design of trap dipoles, as will be seen later.

Option 4 calculates the values of inductance and capacitance required for a parallel LC trap, given the resonant frequency and the inductive reactance at a lower frequency. This function is essential for the design of trap dipoles.

Option 5 also calculates values for an LC trap. Given any two of the resonant frequency, the inductance and the capacitance, it will calculate the third value. ▶

$$L = \frac{10^6}{68\pi^2 f^2}\left\{\frac{\left[\ln\left(24\left(\frac{234}{f}-B\right)\Big/D\right)-1\right]\left[\left(1-\frac{fB}{234}\right)^2-1\right]}{\frac{234}{f}-B} - \frac{\left[\ln\left(24\left(\frac{A}{2}-B\right)\Big/D\right)-1\right]\left[\left(\frac{fA}{2}-fB\right)\Big/234\right)^2-1\right]}{\frac{A}{2}-B}\right\}\ \mu H$$

where A is the overall length of the dipole in feet, B is the distance from the centre of the dipole to the loading coil. D is the diameter of the radiator (wire or tube) in inches, and f is the frequency in MHz.

Option 6 calculates the inductive reactance of an LC trap at a frequency below the resonant frequency. The inductive reactance is then converted into an equivalent inductance at the lower frequency; this calculation is also required in the design of trap dipoles.

Option 7 applies the well known formula (found in any ARRL *Radio Amateurs Handbook*) to find the number of turns required on a former to provide a specified inductance value. Option 8 is the way out.

APPLICATIONS

Simple loaded dipole

Determining the loading inductance required to resonate a dipole with an overall length less than a physical half wavelength is a straightforward application of menu option 1. For example, if you have space for a dipole 20 metres long, and you wish to load it for operation on 3.6 MHz, then select option 1 from the menu, enter 3.6 for the frequency, 20 metres for the overall length, your choice of the distance of the loading coil from the centre of the dipole, and the diameter of the wire being used.

The distance of the coil from the centre is not predetermined — you must specify it. The further from the centre is the coil, the higher the value of L, and thus the higher the resistance of the coil, for a given wire diameter. On the other hand, the closer the coil is to the centre, the higher will be the current flowing in it, and thus the higher the power dissipated in the (lower) resistance of the coil.

There will be an optimum position for maximum efficiency for a given set of physical parameters (dipole length, wire size, etc.), but this position is not determined by the program. Thus, there remains some scope for experimentation!

To get back to the example, if you select a position 5 metres from the centre and use wire 1.6 mm in diameter, the program will respond with "Loading Coil is 41.6 microhenry", and give you the option of doing further calculations. You can then select menu item 7 to calculate the number of turns required with a given former and wire size, to produce the required inductance.

Two-frequency trap dipole

Let us suppose you have space for a dipole 30 metres long, and you wish to use it as 3.6 and 7.05 MHz. Since 30 metres is longer than a half wavelength at 7.05 MHz you can put traps, resonant at 7.05 MHz, a quarter wavelength from the centre, thus achieving a half-wave dipole at 7.05 MHz; the trap is inductive at 3.6 MHz, and will act as a loading coil at 3.6 MHz. The requirement is to select the inductance (and thence the capacitance) of the trap correctly. Proceed as follows:

(i) Select menu option 1.
(ii) The operating frequency is 3.6 MHz.
(iii) The overall length of the dipole is 30 metres.
(iv) Calculate a quarter wavelength at 7.05 MHz, less 5% to be 10.11 metres (not in the program — use your calculator!). This is the distance of the loading coil (i.e: the trap) from the centre of the dipole.
(v) Input the wire diameter, say 2 mm.
(vi) The program gives the required loading, 28.0 microhenry.
(vii) Use menu option 3 to convert the loading inductance (28.0 μH) into inductive reactance at 3.6 MHz. The program returns a value of 633.35 ohms.
(viii) Use menu option 4 to calculate the trap values required. The resonant frequency is 7.05 MHz, the trap has an inductive reactance of 633.35 ohms at 3.6 MHz. The program returns values of 20.7 microhenry and 24.6 picofarad.

By using parallel resonant traps of 20.7 μH and 24.6 pF, the dipole will be resonant on both 3.6 and 7.05 MHz.

Of course, the value of 24.6 pF is not a preferred value. To use the nearest standard value (27 pF), calculate the inductance necessary to resonate with 27 pF at 7.05 MHz, using menu option 5. Enter "?" for the value of inductance, and the program will calculate the required value, in

```
100 REM * LOADED DIPOLE DESIGN PROGRAM.
120 REM * WITH ADDITIONAL ROUTINES NECESSARY FOR TRAP AND
130 REM * LOADED-TRAP DIPOLE DESIGN.
140 REM *
160 REM * PREPARED BY ANDREW BOON, VK7AW, 12th OCTOBER 83.
170 REM *
180 REM * Menu of available functions.
200 PRINT: PRINT "The Following Functions Are Available:": PRINT
230 PRINT "1.  Calculate Inductance of Loading Coil for Loaded Dipole."
235 PRINT "2.  Calculate Length of Dipole with Given Loading Inductances."
240 PRINT "3.  Convert Inductance into Inductive Reactance."
250 PRINT "4.  Calculate L,C for a Trap Filter, Given f0, fL & XL."
260 PRINT "5.  Calculate f0, L, or C for a Trap (one unknown)."
270 PRINT "6.  Calculate Equivalent Inductance of a Trap at Lower Freq."
280 PRINT "7.  Calculate Number of Turns For a Given Inductance."
285 PRINT "8.  Exit From This Program.": PRINT
300 INPUT "Your Selection (1 to 8, Return) ";S
310 IF (S<>INT(S)) OR (S<1) OR (S>8) THEN 300
315 IF S=8 THEN END
320 ON S GOSUB 1000,2000,3000,4000,5000,6000,7000
340 PRINT: INPUT "Any More Calculations (Y/N, Return) ";A$
350 IF (A$<>"Y") AND (A$<>"N") THEN 340
360 IF A$="Y" THEN 200 ELSE END
1000 REM * Dipole Loading Coil Calculation.
1010 REM * Based on formula of Jerry Hall (K1PLP) in "QST", Sept. 1974.
1020 REM ************************************
1040 PRINT: PRINT "Dipole Loading Coil Calculation.": PRINT
1060 INPUT "Operating Frequency in MHz ";f
1065 IF f>0 THEN 1070: GOSUB 10000: GOTO 1060
1070 INPUT "Total Length of Dipole in Metres ";A
1075 IF A>0 THEN 1080: GOSUB 10000: GOTO 1070
1080 INPUT "Distance from Centre of Dipole to Loading Coil, metres ";B
1085 IF B>0 AND B<A/2 THEN 1090: GOSUB 10000: GOTO 1080
1090 INPUT "Diameter of Wire used in the Dipole (mm) ";D
1095 IF D>0 THEN 1098: GOSUB 10000: GOTO 1090
1098 GOSUB 1200
1100 PRINT: PRINT USING "Loading Coil is ###.#",S6;
1105 PRINT " microhenries.": PRINT
1110 RETURN
1200 REM Calculate loading coil inductance.
1210 REM For formula see "QST", Sept. 1974, p.28.
1230 S1=1E6/(223.1*(PI*f)^2): S2=71.32/f-B
1250 S3=1-f*B/71.32: S4=A/2-B: S5=2000/D
1280 S6=S1*((LOG(S5*S2)-1)*(S3^2-1)/S2 -(LOG(S5*S4)-1)*((S4*f/71.32)^2-1)/S4)
1290 RETURN
2000 REM * Determine Physical Length of a Resonant Dipole with Loading Coils
2020 REM * of Inductance L microhenry, B metres from Centre of Dipole.
2040 REM ************************************************************************
2050 INPUT "Value of Loading Coils, uH ";L
2055 IF L>0 THEN 2060: GOSUB 10000: GOTO 2050
2060 INPUT "Frequency of Operation (MHz) ";f
2065 IF f>0 THEN 2070: GOSUB 10000: GOTO 2060
2070 INPUT "Diameter of Dipole Wire (mm) ";D
2075 IF D>0 THEN 2080: GOSUB 10000: GOTO 2070
2080 INPUT "Distance of Loading Coil from centre (m) ";B
2082 REM Check that Coils are not too far out.
2090 W=0.5*300/f*0.95: REM 95% of a half-wavelength.
2100 IF (2*B<W) THEN 2120
2110 PRINT "Loading Coils Beyond Quarter-Wavelength.":RETURN
2120 MI=2*B: MA=W: REM Minimum and Maximum possibilities.
2125 A=0.5*(MA+MI): REM Next Guess for A is midway between Min and Max.
2130 GOSUB 1200: REM Calculate Loading Coil for this Position.
2140 IF ABS(L-S6)<0.01 THEN GOTO 2170
2150 IF S6<L THEN MA=A ELSE MI=A
2160 GOTO 2125
2170 PRINT USING "Resonant Length with Loading Coil is ####.##",A;
2175 PRINT " metres.": PRINT
2190 RETURN
3000 REM * Convert Inductance to Inductive Reactance, at a given Frequency.
3020 REM ************************************************************************
3030 INPUT "Inductance, microhenry ";L
3035 IF L>0 THEN 3040: GOSUB 10000: GOTO 3030
3040 INPUT "Frequency, MHz ";f
3045 IF f>0 THEN 3050: GOSUB 10000: GOTO 3040
3050 PRINT USING "Inductive Reactance is ####.##",2*PI*f*L;
3060 PRINT " Ohms.": PRINT
```

Design of loaded and trap dipoles

this case 18.9 microhenry. Then, using menu option 6, the equivalent inductance of the trap at 3.6 MHz is calculated i.e.: 25.6 μH. Use menu option 2 to calculate the exact length of a loaded dipole operating at 3.6 MHz with a 25.6 μH loading coil at a distance of 10.11 metres from the centre. The value obtained is 30.48 metres. By cutting the dipole to 30.48 metres overall length (including the physical length of the loading coil formers), you have a dipole which is resonant on both 3.6 and 7.05 MHz, and a trap which uses standard values of capacitance, i.e: 27 pF.

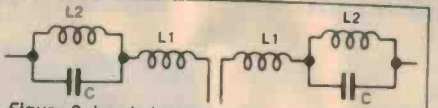


Figure 2. Loaded trap dipole.

Loaded trap dipole

For applications in more restricted space than Example 2, the dipole could be loaded for operation on the higher frequency. For example, if only 20 metres was available for the dipole and operation on 3.6 and 7.05 MHz was required, one possibility would be to place a loading coil three metres from the centre, and a 7.05 MHz trap six metres from the centre. We thus form a loaded dipole on both frequencies, with two pairs of loading coils for the lower frequency, as in Figure 2. Proceed as follows:

(i) Select option 1 to calculate the value of the inner loading coils, L1. Use 7.05 MHz, 12 metres as the overall length, three metres from the centre to the loading coil and, say, 2 mm wire. The program calculates 14.4 μH as the loading coil value.

(ii) Use option 2 to calculate the physical length of a dipole resonant at 3.6 MHz, when loading coils of 14.4 μH are placed three metres from the centre. The value calculated is 27.21 metres. The full span of a half wave dipole at 3.6 MHz is 95% of the actual value, i.e: 39.58 meres. Thus the loading coil has the effect of shortening the half wave dipole by 39.58 − 27.21 = 12.37 metres.

(iii) Use option 1 to calculate the inductance required of the traps to resonate a dipole of length 20 + 12.37 = 32.37 metres, at 3.6 MHz, when the trap (loading coil) is placed 6 + 12.37/2 = 12.19 metres from the centre. This gives a value of 30.3 μH.

(iv) Use option 3 to convert 30.3 μH to inductive reactance at 3.6 MHz. The value returned is 685.37 ohms.

(v) The trap must resonate at 7.05 MHz and have an inductive reactance of 685.37 Ohms at 3.6 MHz. Use option 4 to calculate the values of L2 and C for the trap. The program returns values of 22.4 μH and 22.8 pF.

Once again, a similar procedure can be followed as for Example 2, to calculate the value of L2 and the length of the outer section of the dipole, if a standard value of capacitance (e.g: 22 pF) is used.

No more examples wil be presented here, but the procedures detailed above can be extended, for example, to tri-band trap dipoles. Simply work outwards from the centre, considering the highest frequency first; the trap for the highest frequency becomes a loading inductance for the lower frequencies. The middle frequency uses a loaded trap dipole (as for Example 3), and the lowest frequency has two loading inductances.

As regards the accuracy of the calculations, K1PLP made the comment (in the *QST* article) that "the final inductance values found by cut-and-try pruning for lowest SWR at the desired frequency have been so close to the value from calculations that a laboratory bridge was necessary to measure the difference." This was referring to simple loaded dipoles.

A loaded trap dipole was recently designed using the procedure of Example 3; the traps and loading coils were made up to the calculated values, and when the antenna was erected, no pruning was required. The SWR minima occurred within 3 kHz of the design values. ●

```
3070 RETURN
4000 REM * Calculate Values of L,C for a Trap Filter, given the Resonant
4010 REM * Frequency and the Inductive Reactance at a Lower Frequency.
4020 REM ************************************************************
4030 INPUT "Resonant Frequency of Trap, MHz ";f0
4040 IF f0>0 THEN 4050: GOSUB 10000: GOTO 4030
4050 INPUT "Inductive Reactance at Lower Frequency, Ohms ";XL
4060 IF XL>0 THEN 4070: GOSUB 10000: GOTO 4050
4070 INPUT "Lower Frequency, MHz ";fL
4080 IF fL>0 AND fL<f0 THEN 4090: GOSUB 10000: GOTO 4070
4090 WO=2*PI*f0: WL=2*PI*fL
4100 C=WL/(XL*(WO*WO-WL*WL))*1E6
4110 L=1/(WO*WO*C)*1E6
4120 PRINT USING "Values for Trap are:  L=####.#";L;: PRINT " uH"
4130 PRINT USING "                      C=####.#";C;: PRINT " pF"
4140 RETURN
5000 REM * Find Resonant Frequency, Inductance or Capacitance of a Parallel
5010 REM * Tuned Circuit, given 2 out of 3 of the values.
5020 REM ************************************************************
5030 INPUT "Resonant Frequency, MHz (or '?' if unknown) ",f0$
5040 IF f0$='?' OR VAL(f0$)>0 THEN 5050: GOSUB 10000: GOTO 5030
5050 INPUT "Inductance, microhenry (or '?' if unknown) ",L$
5060 IF L$='?' OR VAL(L$)>0 THEN 5070: GOSUB 10000: GOTO 5050
5070 INPUT "Capacitance, picofarad (or '?' if unknown) ",C$
5080 IF C$='?' OR VAL(C$)>0 THEN 5090: GOSUB 10000: GOTO 5070
5090 IF f0$='?' AND VAL(L$)>0 AND VAL(C$)>0 THEN 5200
5100 IF L$='?' AND VAL(f0$)>0 AND VAL(C$)>0 THEN 5300
5110 IF C$='?' AND VAL(f0$)>0 AND VAL(L$)>0 THEN 5400
5120 PRINT "Must have 2 values given and 1 unknown.": GOTO 5030
5200 REM Calculate Resonant Frequency.
5210 L=VAL(L$): C=VAL(C$): f0=1E3/(2*PI*SQR(L*C))
5220 PRINT USING "Resonant Frequency is ###.##";f0;: PRINT " MHz."
5230 RETURN
5300 REM Calculate Inductance.
5310 f0=VAL(f0$): C=VAL(C$): L=1E6/(4*PI*PI*f0*f0*C)
5320 PRINT USING "Inductance Required is ###.#";L;:PRINT " microhenry."
5330 RETURN
5400 REM Calculate Capacitance.
5410 f0=VAL(f0$): L=VAL(L$): C=1E6/(4*PI*PI*f0*f0*L)
5420 PRINT USING "Capacitance Required is ###.#";C;: PRINT " pF."
5430 RETURN
6000 REM * Calculate the Equivalent Inductance of a Parallel Resonant
6010 REM * Trap, at a Frequency below the Resonant Frequency.
6030 REM ************************************************************
6100 INPUT "Resonant frequency of Trap, MHz ",f0
6110 IF f0>0 THEN 6120: GOSUB 10000: GOTO 6100
6120 INPUT "Inductance of Trap, microhenry ",L
6130 IF L>0 THEN 6140: GOSUB 10000: GOTO 6120
6140 WO=2*PI*f0: C=1E6/(WO*WO*L)
6150 PRINT USING "(Capacitance should be ###.#";C;: PRINT " pF.)"
6160 INPUT "Lower Frequency, MHz ",fL
6170 IF fL>0 and fL<f0 then 6180: GOSUB 10000: GOTO 6160
6180 WL=2*PI*fL: LE=L/(1-(WL*WL)/(WO*WO))
6190 PRINT USING "Equivalent Inductance at Lower Frequency is ###.#";LE;
6200 PRINT " microhenry."
6210 RETURN
7000 REM * Calculate Number of Turns For a Given Inductance Value,
7020 REM * Coil Former Diameter, Pitch and Wire Diameter.
7030 REM ************************************************************
7040 INPUT "Diameter of Coil Former (mm)" ;A
7050 IF A>0 THEN 7060: GOSUB 10000: GOTO 7040
7060 INPUT "Diameter of Wire (mm) ";D
7070 IF D>0 AND D<A/2 THEN 7080: GOSUB 10000: GOTO 7060
7080 INPUT "Coil Pitch (mm per turn) ";P
7090 IF P>=D THEN 7100: GOSUB 10000: GOTO 7080
7100 INPUT "Inductance Required (uH) ";L
7110 IF L>0 THEN 7120: GOSUB 10000: GOTO 7100
7120 A=A+D: REM Calculate average diameter of coil.
7125 B=1016*P*L/(A*A)
7130 N=(B + SQR(B*B + 1828*L/A))/2
7140 REM Formula from ARRL Handbook, re-arranged and metricated.
7150 PRINT USING "Number of Turns Required is ####.#";N: PRINT
7170 RETURN
10000 REM * Subroutine executed when out-of-range data is detected.
10020 REM ************************************************************
10030 PRINT "Check the Value of Your Data Input.": PRINT
10050 RETURN
```

LETTERS

Sir,

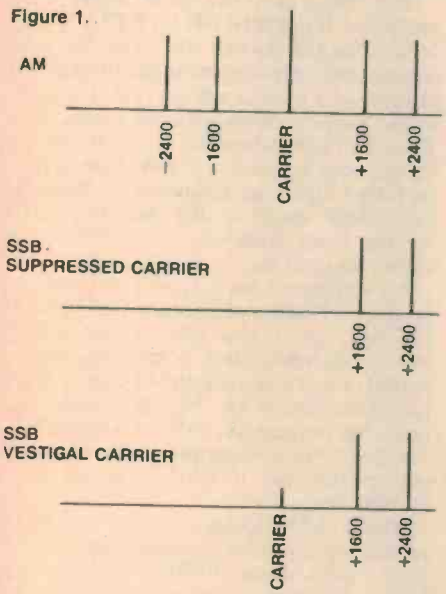
Tom Moffat's article on a fax decoder (ETI, Sept. '83) was good to see but unfortunately there are a few errors which could lead to an incorrect understanding by some readers.

Firstly, amateur fax reception was very popular in the UK about 1959-61. Even in Australia I saw computer board amateur fax systems in 1970.

Secondly, the actual frequencies used, and the method of modulation seem to be misunderstood. In almost every case I have come across in the world, the high tone is *exactly* 2400 Hz. The reason for this will become clear later. An 800 Hz shift down to 1500 Hz is also common.

The modulation method is not just SSB as indicated. In normal amateur SSB systems the carrier may be suppressed by up to 40-60 dB and is really termed *single sideband-suppressed carrier*. However, in most fax work, although only one set of sidebands is transmitted, the carrier is only reduced by about 10 dB, giving rise to the term *single sideband — vestigal carrier*. (See Figure 1.) This vestige of carrier is used in the receiver to phase-lock a carrier insertion oscillator, thus ensuring freedom from drift. (See Figure 2).

Figure 1.



This can be quickly demonstrated on station AXM in just a few minutes. With my FRG7 receiver on 5100 kHz it was actually possible to recover some signal, even in the AM mode. Sure, the level was reduced because of the reduced carrier and only one sideband, but it was still receivable. Going to SSB resulted in a higher output level but introduced unacceptable drift in the 2400 Hz signal.

The requirement for an exact 2400 Hz is a fourth method of synchronisation which was not mentioned. In this method, a 2400 Hz oscillator is phase-locked to the incoming 2400 Hz. The output from the oscillator is then put through a divider chain which produces a 50 Hz or 60 Hz signal which, when amplified, is used to drive the synchronisation motors. This ensures perfect synchronisation because the motors at the transmitting end are similiarly driven from the divided output of a 2400 Hz oscillator there which is used to modulate the transmitter. This removes any reliance on common power grids or drift-free oscillators. (See Figure 3).

Figure 2.

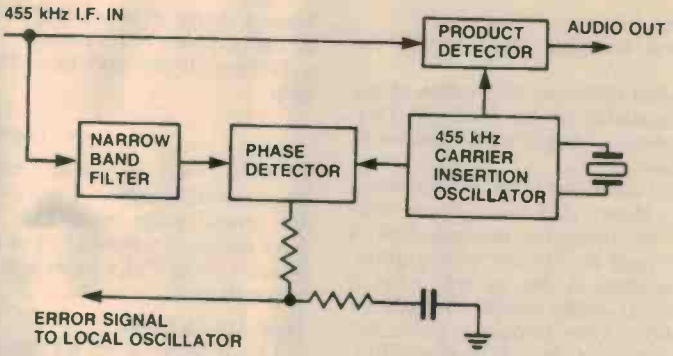
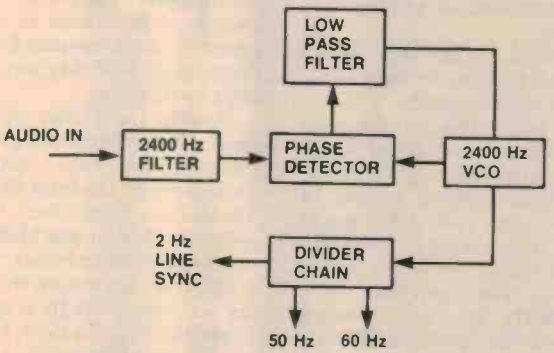


Figure 3.



The simple phase detector/voltage comparator circuit shown in the article is very prone to noise because it really doesn't use the two frequencies which are transmitted, but will activate on the presence or absence of one of the frequencies alone. Modifying the LM311 comparator circuit to provide hysterises should greatly improve performance.

An even better performance for binary type pictures is achieved by having separate narrowband filters for each frequency. The outputs are then detected and used as the inputs to an edge-triggered flip-flop. In this case, the absence of the last frequency will not cause a change of state, only the presence of the other frequency will cause it. This type of circuit is very immune to noise. (See Figure 4).

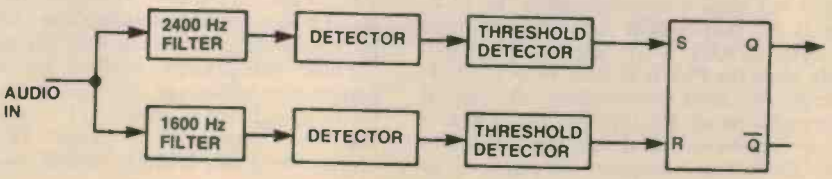
In systems which amplitude modulate the 2400 kHz, the level of the 2400 Hz signal is always kept more than 10% of the maximum level, this residual 10% being enough to lock on to.

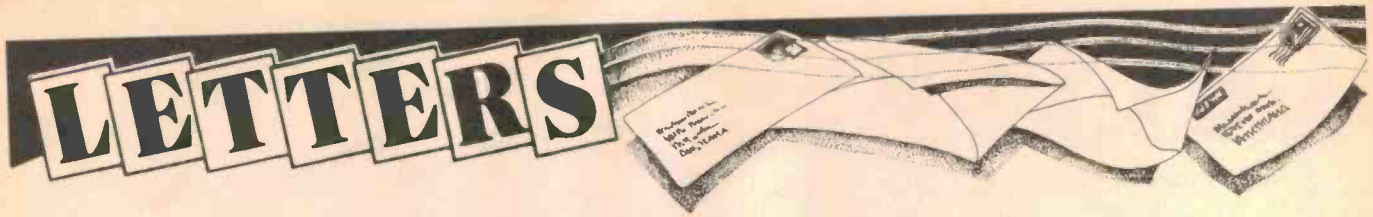
Doug Rickard
Leichhardt, NSW

Thanks for your letter and comments on the ETI-736 fax decoder. Detailed information on the system, modulation and demodulation methods was in short supply, so Tom 'went' with what he could get. The project was kept simple, yet effective and it *does* work quite well. The PLL detector does not work on the basis of the presence or absence of one of the two tones, it requires both tones, (one of which is always present). Adding some hysteresis to the LM311 *may* improve things.

Roger Harrison
Editor, ETI.

Figure 4.





Dear Roger,

Thank you for your letter re the fax decoder.

A very good technical description of fax systems is available in the *Radio & Television Engineers Reference Handbook*, edited by Say.

Your other comment re the phase-locked loop (PLL) shows that you as well misunderstand the operation of phase-locked loops when used in this sort of operation. You are not alone in this, as even a lot of commercially available equipment makes a similar mistake. You can quickly prove this by setting up one of those IC types of PLL and then injecting signal which is different to the rest frequency of the PLL *but* within capture band. Without any input the output will be the quiescent error voltage. As soon as the input signal is turned on, a different error voltage will be generated as the PLL comes into lock. Remove the input signal and the error voltage will return to the quiescent state. Two frequencies are *NOT* required, just one frequency different from the PLL quiescent frequency. All that using two frequencies gives is an increase in the amplitude of the output signal *if* the two frequencies are at opposite sides of the PLL quiescent frequency.

A similar problem occurs with many modem circuits and particularly with some of the Kansas City tape decoders.

Another place where this is seen is in frequency discriminators which use cycle counting or timing techniques e.g: Electronics Australia's digital cassette system of about two years ago. To differentiate between the two frequencies of 2400 and 1200 Hz it used a timing technique where the timing interval was equivalent to a frequency of 1800 Hz. If a zero crossing occured within the timing period a 2400 Hz signal was assumed, and if no zero cossing occured within the timing period, then a 1200 Hz signal was assumed. However, it is patiently obvious that the actual absence of any signal at all would similarly be detected as 1200 Hz i.e: the 1200 Hz signal was totally redundant and unnecessary.

As an example of a *good* design, see the article from *73 magazine* of September, 1982. Although originally designed as an RTTY decoder, it would make an excellent fax decoder. It uses a progressively *soft* limiter, important in relationship to *signal supervision factor* in PLLs. It also uses separate NE567 PLLs for each of the two frequencies. A very important point about the 567 tone decoder is that the output signal is *not* the error voltage from the PLL, but is the output of a coherent amplitude detector (CAD), so an output is generated only when the PLL is actually in lock. (N.B: Watch the loop bandwidths). A 7400 is employed as an RS flip flop to provide a 'slicer' action so that the actual presence of the alternative frequency is required to cause a change of state, *not* just the absence or the presence of frequency.

Hoping all this may have been of some help.

Doug Rickard
Leichhardt, NSW

(P.S. Yes — I have had a bit to do with phase-locked loops — I worked for NASA for several years using PLL systems and have designed a number of satellite ground stations using PLLs as well as many other applications.)

Dear Mr Rickard,

I have received via ETI two letters from you expressing dissatisfaction with my article on facsimile in that magazine. I will now answer some of the points you have made, after which I will consider the matter closed.

First, the matter of previous enthusiast activity in this field. Fair enough, anyone can go out and buy a fax machine, and receive weather pictures at home. Quite a few people are known to do this in America, paying well over a thousand dollars for a fax machine. Perhaps as you say, fax was popular in the UK around 1959-1960. That's not the point. The point of the article was to encourage the owner of a small computer system to use a resource he already has for a purpose he probably never thought of, at little further cost.

Now to the matter of fax transmission itself. The information given in the article came from some textbooks devoted exclusively to fax from the State Library of Tasmania, from the Weather Bureau offices in Hobart and Melbourne, and from my own reference books. I didn't just make it up. Your suggestion that the high tone of fax is exactly 2400 Hz is probably correct in a landline-based system, but the article concerned radio-fascimile, which is normally transmitted as pure FSK (frequency-shift keying).

The article instructed the user to switch his receiver to the SSB mode, the reason being to re-insert the carrier and allow demodulation to audio tones. In this case, the tones can be anything at all, depending on receiver tuning, and I chose 2300 Hz as the high one to ensure it could pass easily through a cheap receiver without a filter.

If you can hear a carrier, other than the two tones, from AXM you've got better ears than I have. The information booklet from AXM, dated 1 March 1983, specifies their class of emission as "F4". The book *Reference Data for Radio Engineers* (of which I am one) defines F4 as "fascimile by direct frequency modulation of the carrier". In other words, frequency-shift keying.

Phase-locked loops — there are always people who either say they don't work, or try to complicate a simple and elegant circuit into a mathematical jungle. The fact remains that the ETI-736 circuit, as published, works extremely well. And it works by locking on to the frequency being received and following it, generating an error voltage which in fact becomes the recovered signal.

I didn't just make this up . . . the same information is available in data sheets on the 4046 PLL published by National Semiconductor, Phillips and Signetics, all of which I consulted before writing one word about the use of the chip. These include interesting discussions of how the PLL follows step changes in frequency, as found in RTTY and binary fax. If you still feel the PLL works in some different way, I suggest you build up the 736 circuit and investigate its operation with an oscilloscope. A picture is worth a thousand words.

Now we're up to your second letter, having brought into doubt the competence of Roger Harrison and experienced equipment manufacturers around the world. The experiment you describe, turning the signal to a PLL on and off, simply shows that it locks up with the signal there and loses lock when the signal disappears. I'd hate to rely on a PLL doing this in step with a signal containing modulation components up to 600 Hz or so.

This brings us to the 'good' design in *73 magazine*. It might be OK for RTTY but it's useless for fax. Here's why: The 567 tone decoder can only respond to the presence or absence of a tone at a finite rate. It's given in the *National Semiconductor Linear Data Book* as Fo/20 where Fo is the frequency the decoder is tuned to detect. Taking your preferred high tone frequency of 2400 Hz, the "fastest on/off cycling rate" is 120 Hz. At the black frequency of 1600 Hz, the cycle rate is 80 Hz.

My "inferior" fax system is required to produce a horizontal resolution of 590 dots per line, so if you take a line full of white/black/white/black transitions, over a period of half a second, the frequency to be recovered would be 590 Hz, nearly five times the frequency a 567 could reproduce. The 567 system might produce a recognizable picture but it would certainly be a blurred one.

The ETI-736 decoder is quite capable of recovering a picture element only one dot wide, even from 10 000 miles (16 000 km . . .Ed.) away. You can see individual dots in the picture on page 92 of the article, making up the latitude and longitude lines.

I do hope this letter has properly answered most of the points you made. It's interesting that other correspondence on this project has all been quite complimentary. By the way, I worked for NASA as well . . . Nevada Test Site 1964, Bermuda 1964, Hawaii 1965, and then back to Nevada again. Did we cross paths somewhere?

Regards
Tom Moffat

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MISCELLANEOUS

WANTED: 'PRACTICAL Electronics', March 1983 or a photocopy of part two of 'Into the real world'. B. Le Marshall, 6 Exchange St, Ballarat Vic 3350. (053)32-2793.

WANTED: TDK magnetic, gold-plated ladies necklace. L. Hollow, 844 Burke Rd, Canterbury Vic. 3126. (03)82-6758.

FOR SALE: OSCILLOSCOPE, National portable VP-5650A with dual trace dc 50 MHz delayed sweep. As new with all probes, manual etc. $1000 Peter (099)36-6035.

FOR SALE: ETI YEAR books, 1-4, 1971-1975 in mint condition. J. Cloosterman, PO Box 232, Hindmarsh SA 5007. (08)333-0529.

FOR SALE: BWD 820, 25 MHz dual trace oscilloscope, near new, $800 ono. Maurice Hamilton,. PO Box 106, Indooroopilly Qld. 4068. (07)370-7529.

FOR SALE: LARGE assortment of components ideal for enthusiasts workshop. Resistors, caps, various semiconductor boards etc. Cheap. Mal, 21 Alstrope Ave, Modbury SA (08)264-8207.

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COMPUTERS

FOR SALE: 8" Shugart floppy disk drives (two) in chassis with power supply and fan. Single sided. $800. Adrian (092)349-3684.

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FOR SALE: TRS-80 32K extended colour basic computer, two disk drives, joysticks. Purchased July 1983. $1700 ono. Michael (03)606-8362 bh or (03)842-2004 ah.

FOR SALE: SUPER 80 dissassembler, $9. Sprocket fanfold paper 243 mm x 280 mm, $19 a box. Siemens M100 Teleprinter $60. R. Vowels, 93 Park Drive, Parkville Vic 3052.

FOR SALE: 16K ZX81 SOFTWARE: ZX monopoly $12, shape table plotter $9, tape copier $9, the lot $25. N. Kefford, 120 Church St, Yass NSW 2582. (062)26-2631.

FOR SALE: FLOPPY disk drive 1 Meg Shugart SA 850/851 DSDD STD Shugart SA 800 I/O compatible IBM 3270 format or hard sector compatible, new in box. $390. Ralph (047)59-1721.

FOR SALE: S100 BOARDS. MW 6545 VDU and 4 MHz DGZ80 to match. Also included set of PROMS to go with CCS 2422 controller to make a complete 8 or 5 inch disk system. Software included. $370 ono. East Ryde. (02)888-7624.

FOR SALE: DGZ80 S100 CPU, DG640 VDU, DGOS SD Expando RAM with 32K, motherboard, power supply, keyboard, monitor, basic plus S/W. Best offer. Gordon (02)587-3449.

FOR SALE: MICROBEE 16K plus, with heaps of software. $350. David (02)871-7090 ah.

WANTED: MICROBEE user in Kingaroy would like to contact others in the area. C. Cuvet, 21 Patrick St, Kingaroy. (071)62-3219.

FOR SALE: NEW computer Hitachi MB 6890, 48K, RS232, Centronics and lightpen port, RGB-colour o/p, 2 x 320K DS/DD drive, green monitor, $2200 ono. Robert (02)662-4150 ah.

WANTED: MICROSOFT Fortran diskette and documentation to suit System 80 or TRS Model 1. Paul Spresser, 2nd Field Supply, Bn Lavarack Bks, Townsville Qld 4813. (077)71-7760.

FOR SALE: MICROBEE complete system including 32K Bee, serial printer, computer monitor, data recorder, all applied tech software and more, blank cassettes, manuals, $1299 ono. Andrew Petty (02)48-3807.

FOR SALE: DISK drive, controller, DOS manual and printer serial interface for Apple II $390. Tested but unused (bought Microbee instead). Alex (03)341-5424.

FOR SALE: DICK Smith VZ-200 colour computer with $30 worth of software and literature. Cost around $230, sell for $195. Peter (03)584-6731.

FOR SALE: LATEST Rev. 7 Apple II Europlus 64K with lower case chip, 16K RAM card, B & W monitor, colour card with RF modulator, disk drive with controller card, Z80 softcard, 80-column card, GP-80M Seikosha dot matrix printer, box of fan-fold printer paper, spare printer ribbon, TKC hand paddles, TG Products joystick, includes all manuals plus extra programming books, over $1500 of original software plus a stack of public domain software, computer fan, box of 10 diskettes, serial printer interface card, plastic protective keyboard cover. $4000 ono. Brian Knott (089)62-3073.

FOR SALE: VIC-20 computer games and utilities. $2 per program, cheaper for bulk. Send SAE for a complete list. Chris Groenhout, 25 Kerferd St, Watson ACT 2602.

FOR SALE: ACT VIC-20 bi-monthly magazine. Many interesting articles and programs. December issue $1.50. Bi-monthly $8 per year. Chris Groenhout, 25 Kerferd St, Watson ACT 2602.

DREGS

The bottom line says . . .
E A B H . . .
V. N. Bligh, Government Printer

I ALWAYS KNEW physics and chemistry couldn't be mixed. Now I'm sure of it. I had to give chemistry away as a high school student after what is best described as 'an unfortunate incident'.

Early on in my high school career I fell in with a bunch of inveterate experimenters. They'd experiment with literally anything they could get their hands on. Lucky I was smaller than my peers, otherwise . . . This, you understand was before we discovered (quick glance over shoulder, say it soto voce) . . . the opposite sex. Those sort of experiments came later.

Anyhow, this bunch, including myself, having satisfied the urge to explore the physics of flattening dry cells (D cells take 7 minutes, 47 seconds, on average) turned to more spectular, if disruptive, pursuits. Making 'touch powder'. Arranged on the stairs of the school science block before morning assembly was dismissed, it proved a smugly satisfying experience to hear the strains of 'Colonel Bogey' punctuated by assorted loud noises and shrieks of surprise from the first group marched to the classrooms.

That experiment over, we went on to greater heights; missile propulsion. We knew all about the physics of paper aeroplanes and spit balls. As missiles went, they had their limitations, i.e: they're only effective at close quarters, have very limited range and can almost invariably be traced to the person who launches them.

Rocketry represented the ultimate. So we combined a little chemistry (made solid fuel) and physics (ignited the fuel by an electric spark). Some (clandestine) early experiments met with success, so we made 'the big one'. It was a thing of beauty. The body was hand polished, the nose cone turned and buffed in the machine shop lathe. The ignition system was a masterpiece of electrical engineering (for the technology of the time, you understand).

What with so much preparation, a great many people had come to hear of this 'best thing since Von Braun's V2'. The maiden flight was to be staged from the (then new) football field one afternoon, witnessed by (at a distance) almost the entire school (or so it seemed). Came the countdown, the switch was thrown . . . we had ignition — a loud bang, a blinding flash, a billowing cloud of richly coloured smoke — and small pieces of rocket body rained down upon the assembled throng who had the temerity to guffaw loudly and make rude, but salient, remarks. Grass still refuses to grow right there, over 20 years later.

We learned our lesson. Chemistry and physics should not be mixed.

It seems others in this world have not learned the same lesson. A respected British medical journal reported recently that the current practice of using nitroglycerine for treating heart conditions should be accompanied by some cautionary practices. Apparently, a 'patch' is attached to the chest and the drug seeps through the skin to effect its work on the heart. However, it was reported that some poor chap who was receiving this treatment, was rushed to hospital suffering from a heart attack. An electric defibrillator was applied — with obvious result and much to the surprise of those administering the treatment. As very little nitroglycerine is used, it's claimed there's little risk and it was reported that not much damage was done, though the patient did not survive his heart attack.

I remain firmly convinced that you can't mix physics and chemistry. ●

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