THE TORPET

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The INDEPENDENT Commodore Users' Magazine No. 19 May 1983

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Articles by Top Authorities

Making Music with your VIC, PET or Commodore 64

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Cover Model: Miss Lorrell Creswell, age 12, lives in Markham, Ontario and attends grade 7 at Dickson Hill Public School. She wants to be a computer programmer.

Letters to the the Editor

I just received my TORPET. Thank you. I must say, your magazine is getting a very professional look about it. Keep up the excellent work.

Glenn Sheild #2798
Milverton, Ontario

...Also, I want to say how much I enjoyed the article on word processors. It was a very helpful feature.

David Nelson Memb. 4578
Sacramento, California

Congratulations on the Mar-Apr issue of TORPET and the best of success on your move.

Gary Chouinard Memb. 3543
Slave Lake, Alberta

We enjoy the TORPET each month and appreciate the hard work you each put into getting it published. It is much help to a family of novices. Thank You.

R. A. Foster Memb. 2575
Albuquerque, New Mexico

I would like to comment on the new format of TORPET. VERY GOOD.

When I received the Mar-Apr issue, I read through and found TPUG contacts on page 6 of the TPUG directory.

Being a VIC-20 user I had some questions about TPUG tapes. I called Dave Simpson (no answer). Then I called Chris Bennett (busy). I tried these numbers for about 2 1/2 hours. So then I tried John Easton (got him the first time). Yes, he answered all my questions and helped me very much.

It is nice to know that if someone is not available that there is someone else you can contact and get help.

Thank you one and all and keep up the very good work.

Joseph Walters # 1957
West Salem, Wisconsin

I'm not too sure just how many of us Texans write you for programs, but I can assure you that those of us in this part of the state certainly appreciate the help we get from our friends up North.

I can assure you that everyone up there seems to be way ahead of us down here in the use of computers. I wish we could just catch up, but it's one hell of a job just to convince most people that computers are here to stay!

When I joined TPUG, it was just a hunch that you folks had something to offer that wasn't available here. Now some of us are trying to get a user group organized in Amarillo, and have already spread the good word about what you are doing up there.

I only wish I could communicate with this VIC-20 and modem to someone in Canada to show people down here that computers are an up and coming thing.

If anyone wishes to communicate with someone from Texas, who is just an ordinary kind of guy, I would like to hear from them.

Thanks youall,
Charlie Broomhead Memb. 2473
Amarillo Texas

As a new member of TPUG I just received my first copy of "The Torpet" and I was not disappointed. If your library of software for the C-64 expands in the same way your PET software has then you will definitely be an important source. I am looking forward to receiving these disks and future issues of your magazine. Too bad I don't live in Toronto. It sounds like the town has gone berserk over Commodore equipment.

Mark Sterling #0918
Wadsworth. Ohio

Thank you for your forbearance and assistance in helping us new Commodore owners with programs and utilities. Your aid is invaluable, and I only wish that you were nearer, so that more of your Southern members could utilize the expertise that you have amassed in the Toronto area.

Robert Cokel # 0487
Monmouth Illinois

COMMENTS FROM OTHER PUBLICATIONS

"...subscription to TORPET which is a very worthwhile magazine with many VIC-related articles in every issue."

VISIONS: Vol. I, Issue I, March/April 83, page 13.

"There are a number of other major developments on the horizon this year worth thinking about. We have all watched our favorite magazines stumble, grow or decline.-... For the Commodore User, we got several good breaks by seeing the Toronto User's Group expand their publication ...

SNUG: No. 1, January 83, page 7.

"Continuing the practice of my heroes at the TORPET and the Midnite Paper, all articles and programs published in the 8-Bit Bozart will be placed in the public domain. Anyone may copy the material for redistribution in other public domain publications, just like I lifted most of this paragraph from the TORPET, February 1983, page 32. I expect any republication to contain an acknowledgement of the source."

THE 8-BIT BOZART: Vol I, April 83, pages 8-9.

Dear Sir:

I want to take this opportunity to express my wholehearted endorsement of your publishing policy as stated on page 34 of the February '83 issue. The members of TPUG, and in particular Jim Butterfield, immensely aid the advances we see almost daily by providing a fertile field where new ideas and discoveries are freely exchanged and so germinate succeeding generations of advancement. It is in such a healthy environment that this amazing new technology will most fully realize its potential.

Yours truly,
Erny Cowan
26 Beavis Terrace
New Liskeard, Ontario
P0J 1P0
Membership #1230

EDITORIAL

A CRITICISM

Dear Editor:

As the Torpet is the primary service and means of communication from TPUG to the associate membership, there exists a responsibility to provide solid, usable information. An important consideration to the local membership is that the Torpet is the main means on which the reputation of this club is judged elsewhere.

It is in the desire that the Torpet put TPUG's best foot forward that I must point out a serious flaw in Editorial judgement in the March/April, 1983 issue. Heading a theme issue on word processors with articles by the editor on 'What Is A...'and 'Checklist For Choosing a Word Processor' is quite appropriate. Following these with a review, written by this same editor, of a word processor designed by this same editor, which incidentally was advertised on the prime spot on inside front cover, jeopardizes the credibility of everything else in the magazine.

I would like to see this published in a "Letters to the Editor" column, though there is not one at present. In order to better foster communication among members I think there should be one of these, as well as a Question Box, where members can air their problems and be assisted by TPUG's experts, or other readers.

I, for one, would be interested to know whether others agree that the old Greenscreen PET/CBM machines are being ignored in favour of the 64 and VIC. If the Torpet has said everything it ever intends to say about the Greenscreens, I should probably let my TPUG membership lapse, and hide myself away with my pile of back issues to keep me and my poor, obsolete SUPERPET company.

T.S.

EDITOR'S REPLY

Dear T.S.

Please be assured that we do not object to criticism. We know we are not perfect. However, your letter is the first negative one we have received, (and we appreciate that you bothered to write) although it certainly isn't the first critical comment that we have heard.

First of all the only reason the editor has to write articles is because others fail to do so. I have several times noted in the TORPET that I would rather edit than write and that I would publish other's articles first as long as they were available. Several people promised me articles on word processers and from my point of view they failed me. The cover had already been printed so I wish you could tell me what I could have done instead.

We have tried the answer box idea several times without much success. However, if you wish to try again, be my guest. Also, here is the beginning of a letter's to the editor column. We'll give it a try and see how well it does.

As for your complaint that I advertise in the magazine -that is really a low blow. Some other advertisements failed to appear at the last minute and we stepped into the fore at our own expense to take up the gap. I guess you will be doubly offended that we have had to do the same again this issue. We really appreciate the support of our advertisers like RTC, who have done a lot for us. If you find us others, believe me we will only appreciate it.

And one last thing, before writing this response I took the trouble to check the list of over eighty people who have either attended the TORPET interest meeting or who have written the TORPET offering to help, and I didn't find your name on the list.

By the way, check that last issue of the TORPET again and you will see that there were only 8 pages devoted to machines other than what you call the green machine. And this issue has only 7. Most of the articles both there and here have application to all Commodore users.

Editor

Honorary Editor

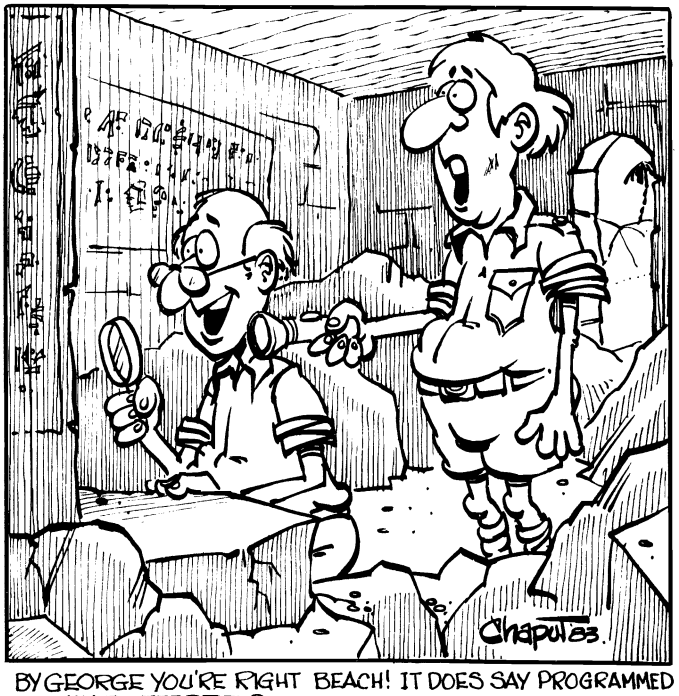
I think you have a point on the split in Commodore users. Maybe we should be divided less by machine than by interest group and by level of knowledge. When I dropped into a VIC meeting recently, I found that many of the questions I was asked would be good for beginners on all machines - VIC, PET, or 64.

BASIC programs are especially portable between machines. As I've said before (and I'll say it again because I'm heavily into redundancy): The owners of different machines have more to learn from our common knowledge than from our differences.

Heck, I can't attend all the meetings that are starting to crop up ...and I'd be interested in all of 'em.

Should we try to think about the splendid SYSOP suggestion, VIZ., We might split better on learning levels than we do on machines?

Jim Butterfield



BY GEORGE YOU'RE RIGHT BEACH! IT DOES SAY PROGRAMMED BY JIM BUTTERFIELD.

FEATURE

Making Music With Computers

by Michael Bonnycastle
Toronto

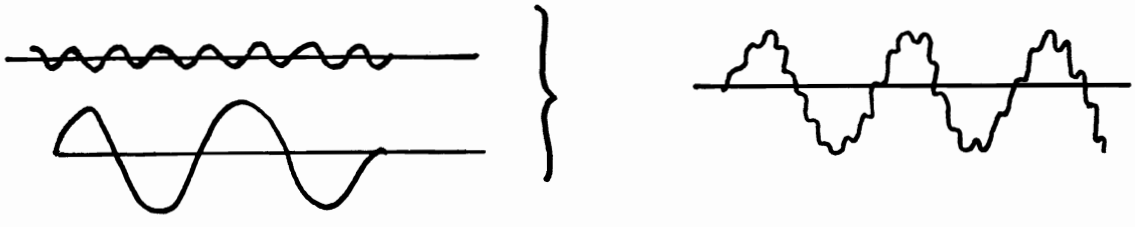
Making music with a computer is one of the many activit ies available to the owner of any of the CBM machines. I started with the small keyboard 8K PET and have carried on with this hobby on and off for the past several years. The PET or CBM computer, or the VIC or the 64 makes quite an adequate synthesizer and while not, perhaps, of professional quality, it can provide tremendous challenge to anyone musically inclined.

To use a computer to make music, you simply attach the accessories required, load and run the programs, and listen. In this way the computer is somewhat like a record player, although the sound is uniquely generated each time it is played. But the sense of accomplishment is far greater if you actually generate the music yourself. I am going to try to explain in a very simple way how music is created, and then you can explore this world yourself.

The first thing to understand, before creating music on the computer, is how sound is produced. This was covered in grade 11 and 12 science when I went to school, but briefly, sound occurs when vibrations are set up in the air, much like ripples occur when a stone is dropped into a still pond. Practically anything can start the vibrations, and they travel through the air acting on our ears and we "hear" the sound. Most vibrations are very complicated and the "voice" we hear is a complex mixture of vibrations that are shaped by the source and our surroundings. This is why musical instruments sound differently; some are pleasant, some raucous, some rich and mellow, some harsh and unpleasant.

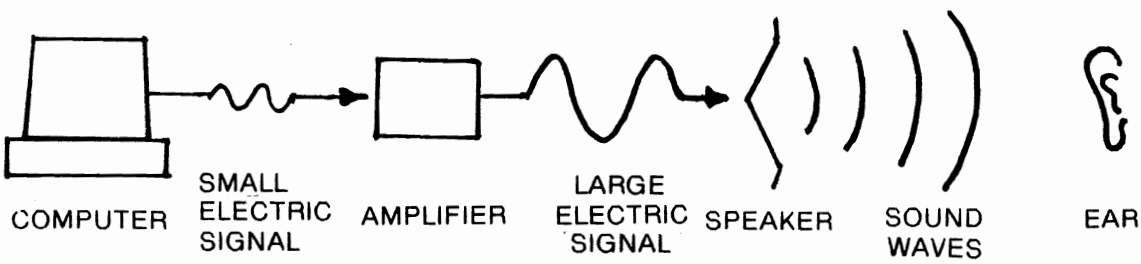
If we're going to produce sound using the computer, we must produce vibrations in the air of the right complexity or shape and of the right frequency. Frequency is the number of times, in a second, that hills and valleys are formed and these we call tones. If the waves come at sixty times a second, the sound is low. Four hundred and forty cycles per second is middle, or concert A and 15,000 cycles per second is a very high pitched sound. The loudness depends on how big the waves are from peak to valley, or amplitude, and once again the quality of the sound depends on a very complicated mixture of high pitched waves of, say, low amplitude together with higher volume waves of lower frequency.

In order to produce sound, something must vibrate, and in this case, it will be a speaker. A speaker produces waves in the air that are very similar to the frequency, shape, and amplitude of the electrical signal which it receives, so to produce sound



Addition of waves to make a complex sound.

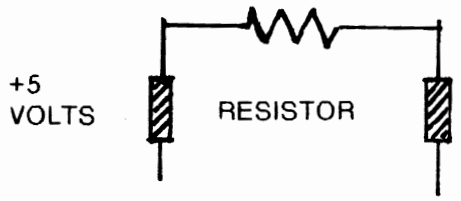
FEATURE



using the computer, we program the computer to generate electrical signals of the desired frequency, shape and size (amplitude) and send these to a speaker. But a computer can develop only very small signals and these must be sent to an amplifier and increased in magnitude so the speaker can be heard.

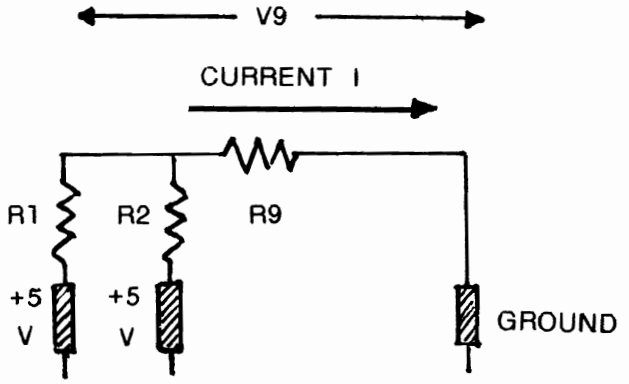
To produce a signal on the PET or CBM computer is fairly simple, once you know how. On the back of the computer is the parallel port which contains a CB2 connector, eight other connectors and a ground connector. There are several other connectors which we'll ignore. There are two ways to produce sound from this port. The first is the CB2 pin and this is connected to an oscillator which can be turned on by poking 16 into location 59467 and 15, 51 or 85 into location 59466. Once the CB2 is turned on, you must set the frequency by poking a value from 1 to 255 into location 59464 and it will continue to send out a constant frequency signal until it is turned off by poking 0 into location 59467 or changed by poking another value into the control location. The frequency of the signal depends on the value poked into 59464 and the shape of the wave produced is a square wave. You cannot control the amplitude, but it is great for game sounds, simple tunes, etc. For more on controlling the CB2 check with some of the early Transactors eg June 1978.

To produce music, however, there is a much better way, and that is what the eight parallel port connectors controlled by locations 59459 and 59471 are for. If one of these pins is connected to the ground pin through a resistor, and the pin is turned on by poking 255 (all 1 bits) in location 59459 and a 1 bit corresponding to the pin being used, five volts will appear on the pin and a small current will flow through the resistor.



The amount of current, of course, depends on the value of the resistor.

If two pins are turned on and current is forced through two resistors from the pins as shown below, the current at I (through a third resistor R9) will be the sum of the two currents generated by turning on pin 1 and pin 2.



Finally, the voltage at V9 will be proportional to the current flowing through R9. If R1 is twice the value of R2 then four different voltages at V9 can be obtained. 0 volts if pin 1 and pin 2 are both off, a small voltage if pin 1 is on, a larger voltage if pin one is turned off and pin 2 is turned on and still a larger voltage if pins 1 and 2 are both turned on.

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With eight pins, and eight resistors, each double the value of the previous one, 256 different voltages can be obtained by turning off and on various pins. The difference between the different, successive voltages is so small that one can virtually obtain a continuous scale of voltages between zero and the maximum voltage. This is how a digital signal is converted to a scaled, or analog signal - hence the term digital to analog converter or DAC. To produce music you will need a DAC on the parallel port of your computer. Construction of a DAC is shown on page #10.

To produce a musical tone, the music program places a bit pattern over time on location 59471 thus turning on and off the pins of the parallel port to generate varying voltages on the DAC. These correspond in frequency and shape to the tone to be produced. The program must work very quickly to do this, changing the bit pattern 30-90 times for each wave, or in the case of concert A which is 440 cycles per second, 30 x 440 or 14,200 times each second. A machine language program is required to do this, and to play a series of notes, the machine language program picks, from a table or list of notes to be played, the particular note, and the duration of that note. It then jumps into a very tight loop for the duration of that note and samples a table which defines the shape of the tone. It cycles at the proper frequency through the table, placing the amplitude pattern for the tone into location aaaaa. Thus varying voltages are sent through the DAC to the amplifier and then to the speaker. When the duration of the note is up, the machine language program picks up the next note from the table and plays it. Thus an entire musical piece can be placed in a table which contains the frequency and duration of each note, and when the program is run, the notes are generated and sent through the parallel port and DAC to the amplifier. In fact, the machine language program runs so fast that up to four separate notes can be added together and played simultaneously in this manner.

All PET CBM music (other than CB2 music) is created this way. While the programs differ, they all consist of machine language programs which must be loaded first, and then other program files (which are actually "machine language" or binary files) which contain the note tables for each piece are loaded in afterwards. When the program is run, it plays the notes contained in the tables.

On the TPUG Music disk (S1) there are several such programs. The first thing to do is to load "NEW ROM MUSIC" (or "OLD ROM MUSIC", depending on your machine) and then load the particular piece to be played. Then type RUN. Once the piece is finished, another music piece may be loaded and run as the music playing program is already resident.

There have been a few commercial programs written making use of this technique for generating music. HUH Electronics produced a DAC for the PET together with a machine language program called the "PETUNIA". It was a very elementary program and the tables had to be poked into memory using a basic program. This was based on the original work by Hal Chamberlin as published in BYTE in September,1977. HUH Electronics has since gone out of business.

Frank Levinson produced a package called VISIBLE MUSIC MONITOR which runs on the 32K PET and is sold by A B Computers in Montgomeryville in Pennsylvania. This program allows you to enter notes on a score displayed on the screen. You can scroll back and forth, enter changes, and then play the piece, and as it plays, the score is displayed. The entered piece can be saved, and it can be raised or lowered a semi-tone, speeded up or slowed down as desired when played.

The author has also produced a commercial package called MUSIC ZZ which allows you to enter the notes using their letter names. They are displayed visually on the screen and can be compared to a score as they are being entered. Once entered, the piece can be played, changed, and when done, saved on disk or tape. This runs on the 40 column PET and will run in 8, 16, or 32K.

FEATURE

Frank Covitz and Hal Chamberlin have worked together using the PET and have refined the technique to include wave shaping with attack and decay so that real musical instruments can be closely simulated. These programs are sold commercially through MTU - Micro Technology Unlimited, North Carolina.

VIC and Commodore 64 music programs work somewhat differently, in that the generation of tones takes place in specially designed synthesizer chips called "SID" chips. These chips generate the wave forms directly and send them out over an audio output, thus bypassing the need for a DAC. The same theory applies, however, in that you must provide a table of notes and directions which are sent to the SID chip telling it which notes to generate, and for how long. Sample programs come with these computers and several music playing programs are on the TPUG VIC and C-64 library disks.

And for those who are really interested in music for the PET, or other Commodore computers, be sure to come to the Conference in May '83. There will be several special sessions specifically for the music enthusiast.

M-U-S-I-C by Computer

by Wes R.D. Wraggett

Royal Conservatory of Music, Toronto

At one time in the dim, dim past, music by computer was something relegated to the fantasies of science fiction writers or to the mathematician/technician types who spent many hours and days with large systems waiting for their expensive ration of sound. Today, thanks to the low cost micro and numerous hardware/software configurations, computer music is becoming accessible to a broad cross-section of people.

Generally speaking, music by computer can be divided into two categories and characterized by two forms of usage. The first category is computer-assisted music. Here the computer is used either to provide possibilities for types of musical materials and their formal organization (this is more or less infrequent usage) or, to provide precise control of an analog sound synthesizer via interface, a so-called hybrid system. This last application is by far the most commonly used today.

Computer generated, the second category, is a truer rendering of the term "computer music" due to the fact that not only is the computer used for control of events, it also generates the sounds used.

There are advantages and disadvantages to both which will be discussed at the end of the article.

The two forms of usage could loosely be termed "constructional" and "instructional". In the constructional mode, either of the above two categories are used to create a musical or functional sound product. Here the computer is a paid assistant, on hand to (hopefully) speed the process of creation/generation.

A computer in the instructional mode puts on another hat and becomes a music tutor, providing musical materials via CMN (Common Music Notation) and aural examples.

Regardless of the application, the fundamental concept which underlies all of the above is sound generation and organization. In both the analog and digital systems oscillators (sound generators) are used to produce frequencies which can be classified into three areas of perception.

1. Definite Pitch

In this area, the sounds we hear have a fixed frequency, that is, they have a regularly repeating cycle of vibrations (the acoustic basis of sound). These pitches are generally classed as musical because all the musical instruments and singing voices we

hear are producing definite pitches (ie. C,D,E, --Do,Re,Mi, etc.). They are definitely pitched because, given the second as a reference measurement, each cycle, a by-part vibration consisting of a high value (condensation) and a low value (rarefraction), reproduces itself "x" number of times every second.

Middle "c" on the piano, for example, vibrates the ear drum 261 times or cycles every second. This number, 261, indicates the frequency of these vibrations based Hertz or Hz., the standard one second unit of measurement (a type of sound snap shot). The range of frequencies that humans can hear, for instance, goes from approx. 20 cycles per second (20 Hz), the lowest frequency, to 20,000 cycles per second (20,000 Hz), the highest.

2. Indetermite Pitch

Unlike definite pitch, this area is like an out-of-focus photograph where objects blur one into the other. Here there is no regular repetition of vibration, consequently, a finite assignment of cycles per second cannot be made. This area is called noise and is what you hear if you tune between FM or television stations.

3. Indefinite Pitch

Combining regularly and irregularly repeating cycles of vibrations, we get a sound that's a bit like a slide going in and out of focus. Many percussion instruments, like cymbals, snare drums etc., are in this area. In a music system, some way of creating these three areas is mandatory for any kind of serious use. Oscillators provide definite pitch as well.

Another thing which oscillators produce are waveforms. Every musical instrument has an identifiable sound of its own, no matter what pitch it plays. This factor is called timbre or colour (sometimes referred to as tone) and is an acoustic phenomenon where harmonically-related frequencies are banded together (something like chords on a piano) into a type of sound pyramid.

The base (bass), or lower frequencies are the loudest and the rest get weaker as they get progressively higher. Waveform harmonics are all related to the fundamental or root frequency by integers (ie. 1,2,3,4,5, etc.) and occur in varying proportions of odd and even integers. These waveforms can be used to imitate those musical instruments which most closely resemble them. The following is a list of the waveforms that are most commonly used:

1. Sine wave

This is a pure wave form because it contains no harmonics and is, in fact, the actual waveform of the harmonics themselves. When you whistle, this is the waveform you create.

2. Triangle wave

This waveform consists of odd-numbered harmonics (ie. 7,9,11, etc.) and, because of its limited number of harmonics, is closely related to the sine wave. It sounds something like a clarinet.

3. Sawtooth or Ramp wave

This waveform is the "richest" because it contains even and odd harmonics. Strings and brass are possible with this wave.

4. Square wave

This wave is similar to the triangle in that it contains odd numbered harmonics, but is different because it contains a great many more. It has a "reedy-hollow" sound and is the most used and heard wave in computer games.

5. Pulse wave

This wave is a variant of the square wave in that its on-off time can be varied, giving variable harmonic content.

Waveforms, therefore, can be thought of as instruments and be used in the traditional sense to provide a colour palette. Waveforms by themselves become tedious even if the pitch is changing and it is sometimes necessary to alter their colour by filtering. Because of the limitations of length permitted to this article, I would like to suggest further reading on waveforms, modulation, filtering, and controlling the lifespan of sounds by envelope shapers. An excellent book on this topic is Hal Chamberlin's Musical Applications of Microprocessors, published by Hayden books.

When all the elements of sound, and the system to realize them, have been dealt with we finally come to the point to all of

this, that is, creating music. The task of defining music is complicated and not without its inevitable pitfalls of bias, therefore I have put together an acronym which deals with music in a highly simplistic and practical way:

> (M)aterials available
>
> (U)ser's goals
>
> (S)cheme for organization and realization
>
> (I)nitiation of the above with provision for Interrupt and re-evaluation of progress and program effectiveness to that point.
>
> (C)ompletion of process, if, contingent upon aural evaluation, all conditions set in user's goals have been realized.

Materials available

This is system dependent. If you have eight oscillators (voices) or three (in the case of the C-64) you know your maximum density cannot exceed this number. Control capabilites- is control strictly by alpha-numeric or piano style keyboard? Are there others, etc.? Historically this has always been a factor anyway (ie., "Does the baron have enough money to hire that oboist?")

User's goals

Is it to be a short piece, long piece? Does it accompany some visual activity? Is it for fun or profit? etc. The goals are as diverse as the users.

Scheme for organization and realization

Here we look at the form of the piece, the shaping of content. Possibly, if this is computer assisted composition, the formal scheme could be determined by the computer itself, like whether the piece is sectional (like movements in a symphony) or not. It may in fact have a totally random form that changes each time it's played. In the days of tape music sometimes a scheme for realization (like a musical score) would be required in order to co-ordinate and clarify a series of complex manoeuvers With the computer, however, once the data is input the realization becomes the computer's problem.

Initiation/Interrupt

This is pretty self explanatory. As in programming there are times when a spot check of the program to date helps eliminate a lot of pain later on. In music this can also lead to discovering possiblities or relationships that weren't seen at the time.

Completion/Contingent

Again, this is self explanatory. Running the piece (program) through allows for the consumate test of all of the above. Any flaws or gaps can be detected providing the auditor does not have such a distorted sense of objectivity by this point that it either sounds like garbage or a masterpiece.

It is well beyond the scope of an article this size to go into any depth regarding hardware, software, or for that matter the end result of their interaction with the creative force. Whether one uses a computer assisted, analog-digital system wih its advantage of 'real time' control and disadvantage of analog temperament or a full digital system with its advantage of speed and accuracy and disadvantage of expensive or difficult expansion (and in some cases limited software), the final result should and must be the most important aspect.

Music has always been, and still is, in the process of defining itself. Is it merely a set of varying frequencies/waveforms (melody) accompanied by vertical frequency aggregates (harmony) working at the micro-time level of rhythm and macro-time level of structure? One can only hope that the use of the computer will not only make it easier to muster and expand the resources of the medium but, just possibly, help to expand the very definition of the word music.

Butterfield Box

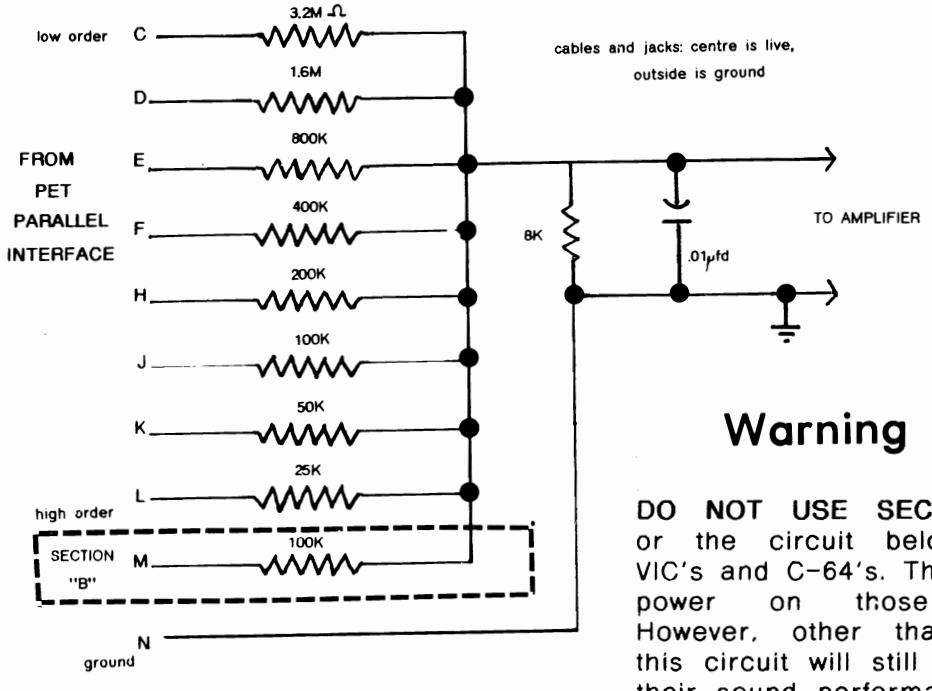
by Jim Butterfield
Toronto, Canada

Poor Man's Petunia

Poor Man's D/A Converter

Cheap; good for generating Chamberlin/style music. Precision resistors are preferred, but most anything will generate a recognizable sound.

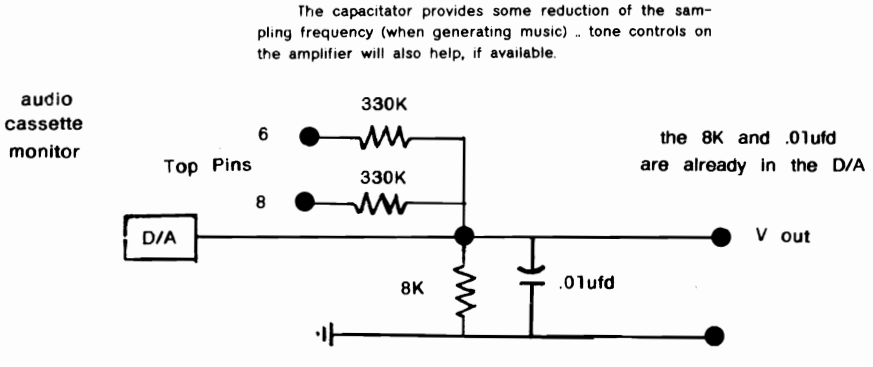
Section B of the diagram supports the CB2 sound effects - so that one interface board covers most sound requirements.



Warning

DO NOT USE SECTION B or the circuit below with VIC's and C-64's. They have power on those pins. However, other than that, this circuit will still improve their sound performance.

The circuit below can be added to the Poor Man's D/A Converter or simply used by itself. Pins 6 and 8 of the User Port (top pins) are connected to the tape read pins on the cassette ports. Due to numerous main logic board variations, it would be too difficult to say which pin belongs to which cassette. But for the price of two 330K resistors, it would be a shame not to hook up both.



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LOADER - Loads the programs created and saved with the other tools. Also lets you save machine language programs onto tape so they may be loadable with usual "LOAD" command.

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FEATURE

Programmers Do It In Software

by Hal Chamberlin

Raleigh, N.C.

Like virtually any task a computer is called upon to perform, sound and music synthesis can be accomplished by purely software means as well as with dedicated hardware. This is seen every day in the personal computer field since one of the main reasons microcomputers are considerably less expensive than the commercial monsters is that most everything is accomplished in software. For example, the floating point arithmetic performed by BASIC is handled by a set of machine language subroutines instead of a hardware floating point processor. Likewise, all of the essential functions of the well known SID (Sound Interface Device) chip in the Commodore 64 can be performed by appropriate software routines in models that lack the SID (such as VICs and of course PETs). As you will see, it is even possible to **exceed** the SID's capability in many respects. The techniques to be described are applicable to any 6502 based computer (Apple, Atari, MTU, Ohio Scientific, Mattel, etc.) and even computers based 6800, Z-80, 8088, 68000 and other processors.

CONS and PROS

Before discovering how it is possible to synthesize high quality, multi-voice music by purely software means, let's take a brief look at the advantages and disadvantages involved. With a hardware synthesizer (and the SID is only one of several around), the circuit designer has already done most of the work for you. Thus, in general, a hardware synthesizer will be much easier to program. In the case of the SID, a few well-chosen POKEs from BASIC are all that is needed to get some kind of sound out. Using the software technique on the other hand the programmer must first "build the synthesizer" in software and then write more software to control it. Furthermore, this software must be in machine language to meet speed requirement. However, for the users of "canned" programs, there may be little difference between the two techniques in this regard.

The more advanced software techniques that are capable of simulating standard instruments with a surprising degree of realism as well as an infinite variety of others require a lot of memory for storing waveform tables. Effective use of these advanced techniques requires a minimum of 16K with upwards of 32K to 64K being desirable. While this may not be much of a problem for C-64 owners or most PET owners, unexpanded VIC owners will be limited to the simpler software techniques that use less memory.

Perhaps the most serious drawback of software synthesis is that it "consumes the entire machine" while sound is being generated. In other words, the sound generating software routines must be in full control every microsecond while sound is being generated. Any break to look at the keyboard or a joystick or to put something on the screen results in a break in the sound. This therefore makes "playing" the computer from a music keyboard a difficult, although not impossible, programming task, particularly if key clicks are unacceptable. As a result, most of the work done with software synthesis involves "coding" a song from sheet music into a music compiler or directly into memory and then having the computer play tthe encoded song.

On the plus side, the software technique can be considerably more flexible than existing hardware synthesis chips. For example, the SID chip has available only three fundamental sound waveforms to choose from although the filter can be used to modify them in a number of ways. The software technique on the other hand uses **waveform tables** stored in memory to define the waveform desired which may be literally any

curve that can be defined by 256(a typical value for available software) independent points. Also the SID has relatively few (16) attack and decay rates to choose from. The software technique on the other hand has a virtually unlimited number of choices plus the attack and decay envelope may be any shape desired, not just single straight lines approximating a standard ADSR shape. Finally, for machines using 1MHz 6502 processors as is the case with all Commodore computers, the software tehnique yields **four** voices instead of three!

There are other pros and cons that will become apparent later but in all cases they are simply tradeoffs among various factors. A clear "winner" that applies in all cases does not exist.

Hardware Needed

Actually it's probably wrong to claim that this is a purely software technique since some specialized hardware actually is needed. Those buzzy old single-voice Altair programs that played through a radio held up to the computer were purely software. The device needed is called a digital-to-analog converter or DAC for short. It does just what its name implies; it converts digital information from the computer (numbers) into analog information (voltages) that is acceptable to an amplifier and speaker system. A DAC is really nothing more than a programmable power supply connected to the computer. When the program sends a value such as +5.32 to the DAC, it produces a voltage level of +5.32 volts at its output which persists until another value is sent to it. A changing voltage level is therefore produced by arranging for the driving program to send a series of numbers to the DAC, each representing a point along the desired voltage contour. An electrical audio signal, which is nothing more than a very rapidly varying voltage level, is thus produced by very rapidly sending numbers to the DAC. Note that the "raw" DAC output is a stair-step approximation to the smooth audio waveform desired. In practice, the DAC must be followed by a low-pass filter to average out these steps and produce a smooth waveform. Figure 1 illustrates this process.

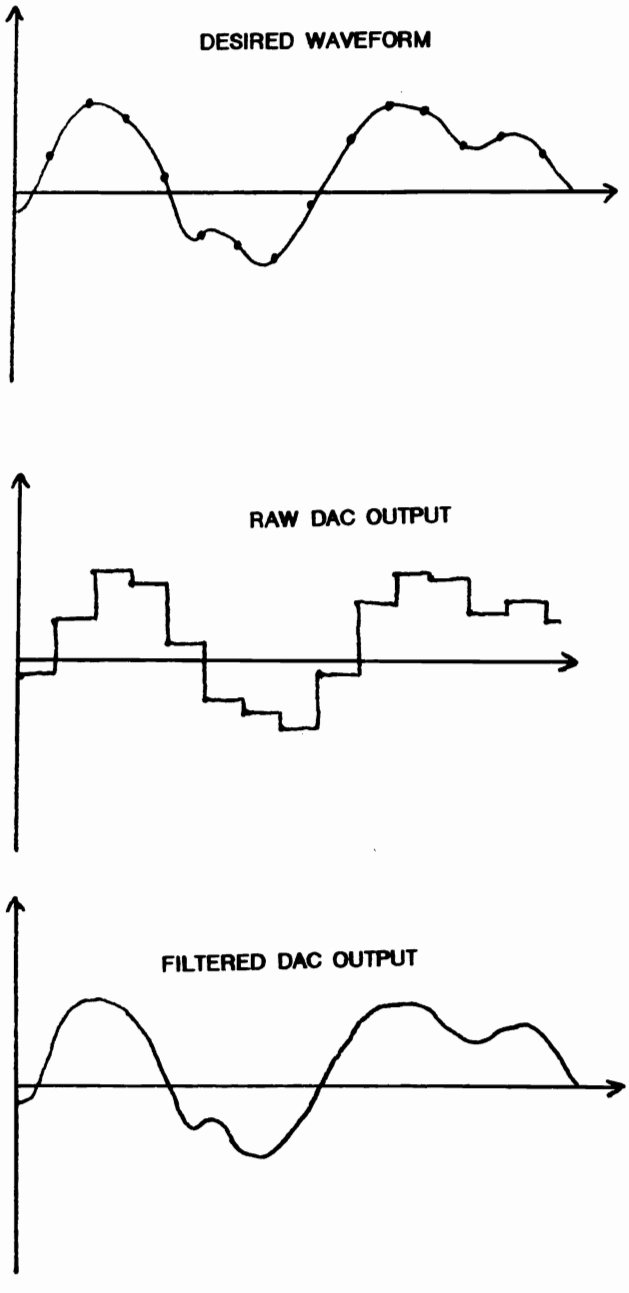


Figure 1: Operation of D-to-A Converter

Unfortunately most personal computers do not come with a DAC standard although a few do such as the MTU-130 and the Ohio Scientific C8P. This is a shame be-

cause a DAC is a very inexpensive circuit to include in a computer's design adding perhaps 2 to 5 dollars to the manufacturing cost. Nevertheless, a DAC may be easily added to to Commodore machines through the User Port and other computers having a parallel I/O port.

- continued next month.

Our next issue will be on games but we will continue the articles by Hal Chamberlin, and Paul Higginbottom, and will also publish another major music article by Dr. Frank Covitz. So stay tuned there is lots more to be learned about making music.

HE JUST REPLACED THE WHOLE STRING SECTION WITH A "C-64".

BIGGEST Commodore Show

If you live west of the Mississippi and you feel it is too far to come to the biggest conference ever (being held by TPUG May 14th and 15th in Toronto - see pages 43 to 45) then maybe you can make it to the largest Commodore show that has ever been held.

The **largest Commodore show ever** is being held May 20th and 21st, at Lion Country Safari in Laguna Migel, California. That is south of Los Angeles about halfway to San Diego.

There will be hundreds of exhibitors with product demonstrations and product presentations of Commodore compatible hardware and software.

It is a combination dealer and end user show and attendance is expected to be over 15,000 per day.

One of the feature attractions will be Isaac the Chimp of TV's **That's Incredible** who will demonstrate his ability to use a Commodore 64.

There will be separate pavilions and tents for business, recreational and eductaional software. The newest products from Commodore will be on display and will be demonstrated. Ted Modrow, the Commodore Service Manager for the Commodore Western Region tells me that there will be a number of surprises.

The cost of admission is $8.25 but this includes admission to Lion Country Safari itself and the attractions usually covered by its general admission.

Sounds like lots of fun! Hope you can make it there.

VIC Composer

by Daniel Walker
Houston, Texas

VIC Music Composer by Thorn EMI is a plug-in cartridge program for the VIC-20. As you may have guessed by the name, it allows you to compose music in three voices on the VIC. You enter your music on the screen as you would on a regular music paper, placing notes on a pre-drawn scale in the desired order. I am not much of a musician, but the program seems to have all the features one could want. You can place rests at any location, pick your own time signature, and change the volume at any point. You can save your creations on tape for future listening. The program also offers editing features which come close to those of VIC BASIC. The manual for this cartridge is fairly easy to follow and is, for the most part, complete. You will probably do better with this program if you are already familiar with music notation. I did an adequate job without much musical knowledge at all. The cartridge sells for $39.95 at Videoland (not a bad price for what you get.)

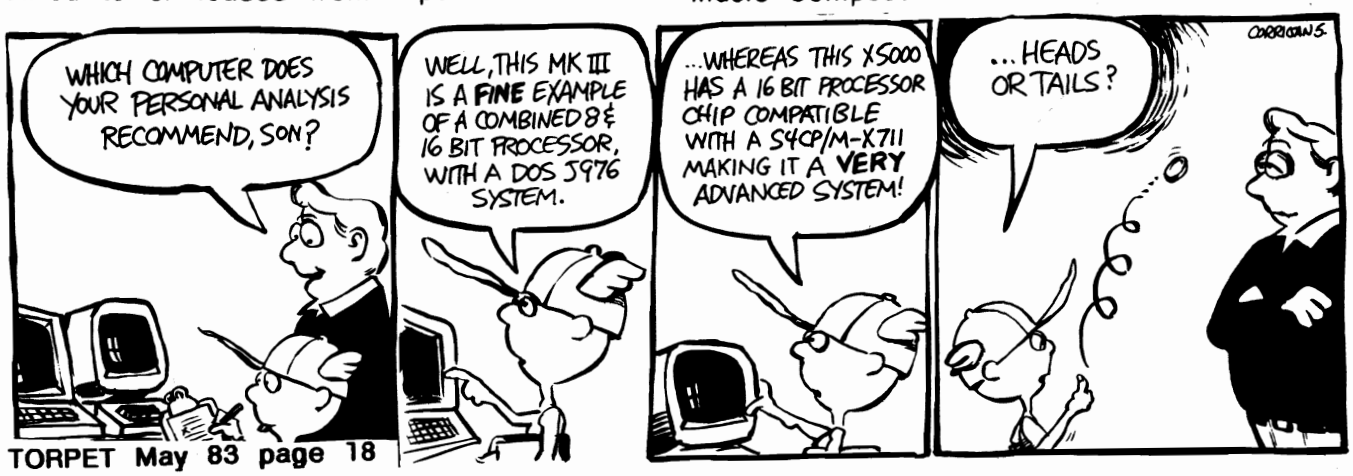
Keep in mind that if you find a program that interests you, the price is no object. Unfortunately, there are those in the software marketing world who also recognize this rule and exploit it. I still feel that most currently available software is overpriced, but its quality is improving all the time. The people at Thorn EMI did a nice job with this cartridge. I think I can live with their price.

A very attractive package with instructions that can be understood easiy by a beginner is one of the VIC Music Composer's strong points. It allows songs to be saved to or loaded from tape. It is in the form of a cartridge, so it takes no RAM away from the user. It uses memory economically (.5 hour in unexpanded VIC; 4.5 hours w/ 16K RAM added). An almost good graphic display of the notes currently being edited is helpful (sorry, only one voice is visible at a time). Its best feature, however, is the ease with which notes can be entered. If that were all there was to say about this cartridge, it would be a good deal. Unfortunately, there's more.

The VIC Music Composer will allow no triplets, no changes to the initial time signature, no key changes and no repeats! Also, as mentioned above, only one voice is visible at a time. This means that at no time can the user look at the screen and see the whole chord as it will sound. And (if that weren't enough) THE DRATTED THING CRASHES! Yep, that's right. If the user goes a little bit lax on his syntax, he risks total annihilation. If he discovers a mistake in an accidental at the end of a page, he should continue entering his music and correct the mistake later.

As with every other music program I have seen for microcomputers, this one allows no slurs and no ties within a measure or over the bar line. Also, it doesn't allow the user to pull an extra fourth voice out of the CB2 port, but no one really expected a VIC product to use any of its vestigal PET organs, did they?

For anything more complicated than "Mary Had a Little Lamb," I would recommend against buying the Thorn EMI VIC Music Composer.



NEW PRODUCTS

Commodore Introduces New Colour Monitor

Consumer Electronics West has introduced the Commodore T701 colour monitor which offers outstanding resolution, superb sound and true-to-life colour.

Housed in an attractive beige cabinet, the 14" screen, operated by seven different controls, offers an excellent image that allows the user to get the most from a home computer or VTR. Separate luminance and chroma inputs ensure that superb clarity is achieved. Suggested retail price in Canada is $539.95 (Cdn.).

For further information:

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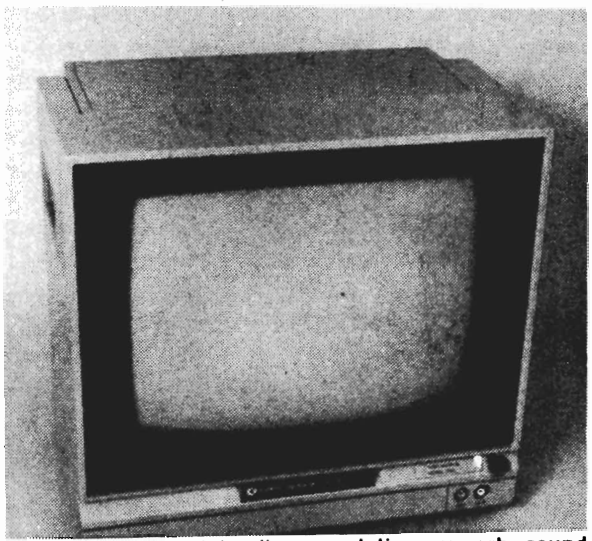

Monitor offers outstanding resolution, superb sound and true-to-life colour.

Commodore WordPro 3 plus for C-64

Commodore Computers has announced that the WordPro 3 Plus software program, previously run on CBM and SuperPet microcomputers, is now available for the Commodore 64.

"This word processing program, developed for Commodore by Professional Software, comes with an excellent User's Guide and a protected disk," said Anthony DeCristofaro, National Sales Manager, Systems Division. "And all the WordPro commands are the same". If a user is already familiar with WordPro 3, 3 Plus, 4, or 4 Plus, he or she will only have to become familiar with the different keyboard on the C-64 to run the program.

The software program is available from authorized Commodore dealers. Suggested retail price is $129.

For further information:

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NEW PRODUCT REVIEW

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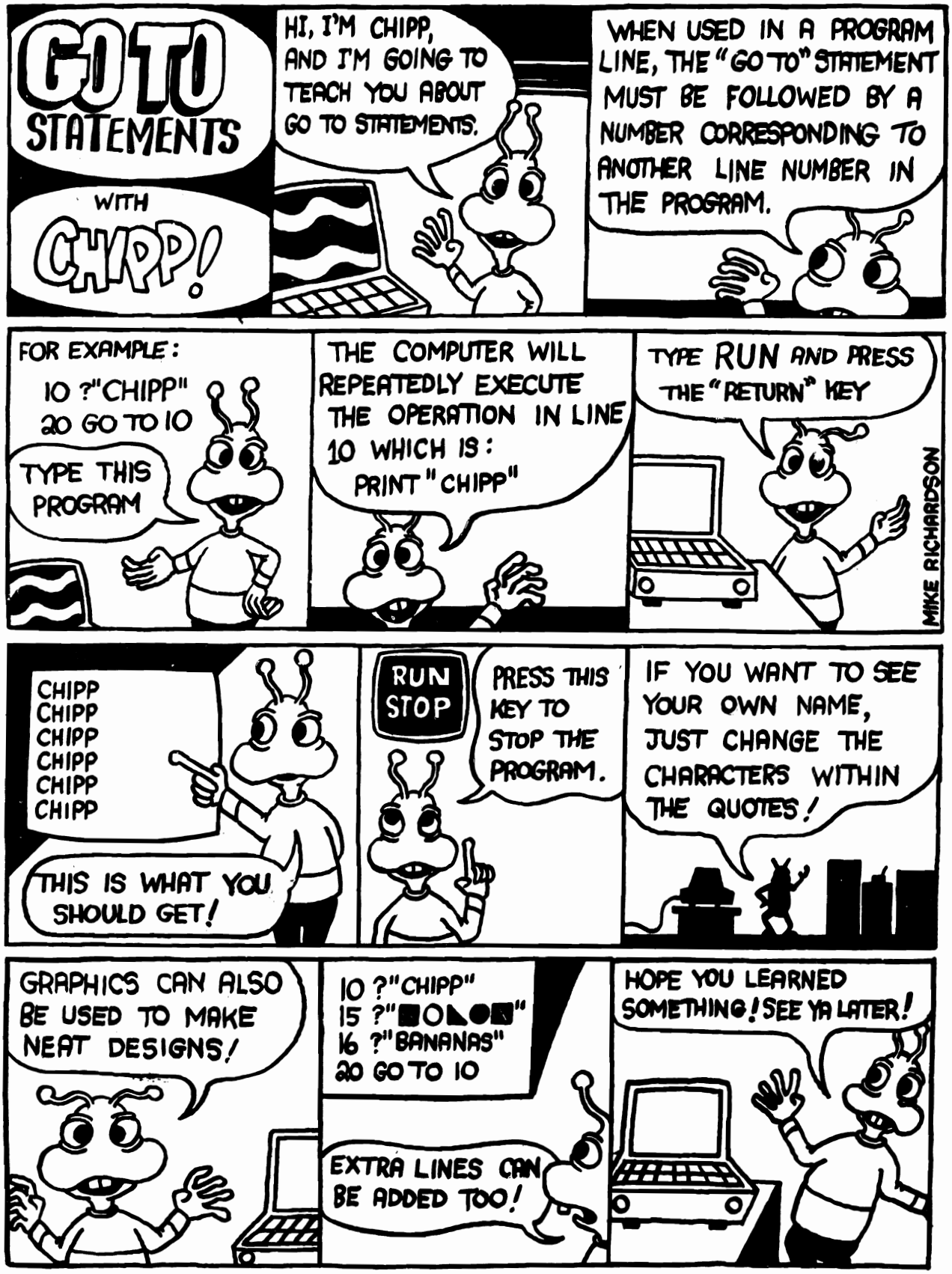
Well I'll just see your Z-80 and raise you three 6502's


GO TO STATEMENTS
WITH CHIPP!
HI, I'M CHIPP, AND I'M GOING TO TEACH YOU ABOUT GO TO STATEMENTS.
WHEN USED IN A PROGRAM LINE, THE "GO TO" STATEMENT MUST BE FOLLOWED BY A NUMBER CORRESPONDING TO ANOTHER LINE NUMBER IN THE PROGRAM.
FOR EXAMPLE:
10 ?"CHIPP"
20 GO TO 10
TYPE THIS PROGRAM
THE COMPUTER WILL REPEATEDLY EXECUTE THE OPERATION IN LINE 10 WHICH IS:
PRINT "CHIPP"
TYPE RUN AND PRESS THE "RETURN" KEY
MIKE RICHARDSON
CHIPP
CHIPP
CHIPP
CHIPP
CHIPP
CHIPP
THIS IS WHAT YOU SHOULD GET!
RUN STOP
PRESS THIS KEY TO STOP THE PROGRAM.
IF YOU WANT TO SEE YOUR OWN NAME, JUST CHANGE THE CHARACTERS WITHIN THE QUOTES!
GRAPHICS CAN ALSO BE USED TO MAKE NEAT DESIGNS!
10 ?"CHIPP"
15 ?"■○◣●■"
16 ?"BANANAS"
20 GO TO 10
EXTRA LINES CAN BE ADDED TOO!
HOPE YOU LEARNED SOMETHING! SEE YA LATER!

VIC

How To Include Machine Language Routines in Your VIC BASIC Programs (without wasting precious bytes)

by Terry Herckenrath
Toronto

Since I've started playing around with my VIC, I have encountered a number of ways of including M.L. routines in a BASIC program.

The most common approach seems to be to include the M.L. routine in the form of DATA statements. At the beginning of the program, a little FOR-NEXT loop POKES the M.L. routine in either high memory or the cassette buffer.

This approach has some drawbacks:

1. The M.L. routine takes up at least THREE TIMES more memory than is necessary.

For each byte of M.L. code you need up to three bytes to represent its value in BASIC, one byte for the actual M.L. code, plus the additional space needed for the DATA tokens, data delimiters (comma's), line numbers, line links and the FOR-NEXT loop to put it all in place.

2. You cannot re-use other information kept in DATA statements.

In some programs it is desirable to read the DATA statements over and over again.

3. The DATA statements can accidentally be clobbered.

While making changes to the program DATA statements can be inserted in the wrong spot, or could even be deleted altogether.

For some time now, I have added M.L. routines to the end of the BASIC text through the use of my M.L. monitor.

Storing the M.L. routine at the end of the BASIC program eliminates the drawbacks cited above. It takes up the minimum amount of space since we are storing the actual M.L. routine; no DATA statements are needed; and YES you can STILL make changes to the BASIC program once the M.L. routine has been appended. BASIC just keeps moving it up and down in memory with the rest of the BASIC program.

There is ONE limitation that I can think of: the M.L. routine must be relocatable; i.e. there can be no JUMP (JMP and JSR) instructions that refer to some point within the M.L. routine. In most cases, this is not a serious limitation.

For those of you who like to understand how the VIC operates: BASIC keeps track of the end of a BASIC program in TWO ways:

1. It keeps track of the LOGICAL end of the BASIC program through a "line link" of zero.

This tells BASIC when to stop LISTING or RUNNING a program.

2. It keeps track of the PHYSICAL end of the BASIC program through the pointer in locations 45 & 46, which points to the byte FOLLOWING the BASIC program. This pointer is used to LOAD and SAVE the program, and for RELOCATING parts of the BASIC program as changes are made to it.

We use this pointer to append the M.L. routine to the BASIC program; then we change its value to tell BASIC that the PHYSICAL length of the the program has increased.

The following three line program will append a M.L. routine to any BASIC program, even if it already has some other M.L. routine appended to it.

```
10000 I% =PEEK(46) * 256 + PEEK(45) +
      4 : PRINT I%

10001 Read J% : IF J% >=0 THEN
      POKE I%,J% : I% =I% + 1
      : GOTO  10001

10002 PRINT I% : J% =I% / 256
      : I% =I% - J% * 256
      POKE 45,I% : POKE 46,J%
      : CLR : END
```

NOTES:

1. The DATA used for the M.L. routine must be followed by a negative value to end the loop.

2. The DATA statements used for the M.L. routine must be the FIRST or ONLY DATA statements in the program.

3. The "+ 4" in line 10000 represents the space needed for the variables I% and J%. These four bytes will be imbedded in the final product and are "wasted".

4. The CLR command at the end of line 10002 will adjust the two pointers used by BASIC to keep track of numeric variables. If you run your program after appending the M.L. routine without adjusting these two pointers, the M.L. routine will get clobbered as soon as a numeric variable is used.

Once the M.L. routine is in place, you can delete the DATA statements and the above program.

You will have to include a statement in your BASIC program that calculates the START ADDRESS or ENTRY POINT ADDRESS of the M.L. routine. You will notice that two addresses will be printed on the screen while the M.L. routine is being appended to the BASIC program. These are the START and ENDING + 1 addresses of the M.L. routine AT THIS MOMENT. Subtract the first from the second to arrive at the LENGTH of the M.L. routine. Then, in your program you calculate the ACTUAL ENTRY POINT ADDRESS as follows:

```
EP% =PEEK(46) * 256
      + PEEK(45) -  MLlength
```

where MLlength is the length of the M.L. routine.

This is assuming that the START ADDRESS and the ENTRY POINT ADDRESS are the same. If you start executing the M.L. routine somewhere beyond the START address, you must adjust the value of MLlength accordingly.

From then on you use SYS EP% when you want to execute the M.L. routine.

If you append more than one M.L. routine to the same program, be sure to re-adjust the entry point address of the "older" routine.

One final word of caution:

Do NOT use "VIC TINY AID" (by Jim Butterfield/Dave Hook) to manipulate a program that has a M.L. routine appended to it. This utility WILL clobber the M.L. routine (and so might other "toolbox" type utilities).

Standard VIC 20

no additional memory needed

(CG008) Alien Panic $12.95
Race against time as your guy digs holes to trap aliens in 4 floor laddered, brick construction site. Requires joystick.

(CG096) Antimatter Splatter $24.95
This game is as good as its name. Another pure machine code game, this one is fast! The alien at the top of the screen is making a strong effort to rid the world of humankind by dropping anti-matter on them. The splatter cannon and you are our only hope as more and more antimatter falls. Joystick again is optional equipment.

(CG026) Collide $12.95
"Vic" controls one, you the other as cars go opposite directions on 4 lane track. Requires joystick.

(CG094) Exterminator $24.95
Recently scoring a rating of 10 out of a possible 10 this game was praised as "one of the best I've seen on any computer" by a prominent reviewer in a leading magazine. The idea is to shoot a centipede before it overuns you, the problem being every time you hit it, it divides into two separate shorter ones. Several other little creatures bounce around during this struggle. All of them lethal. 100% machine language makes the rapid fire action very smooth. A joystick is optional, but as always, recommended, (a trac ball is also very nice!).

(CG054) Krazy Kong $12.95
Three screens, a gorilla, barrels, and changing difficulty levels help to make this one of our most popular. Joystick optional.

(CG098) Racefun $19.95
Extensive use of multicolored character capabilities of the "Vic" make this one very appealing to the eye. Fast all machine language action, quick response to the stick or keyboard controlled throttle, combine with the challenge of driving in ever faster traffic to make it appeal to the rest of the body. Joystick controlling is an option.

(CG058) Rescue From Nufon $12.95
Must find 30 hostages in this 100 room, 5 story, alien infested, graphic adventure game. A continual big seller. Keyboard only (n. = north w = west etc.)

(CG068) The Catch . . . $12.95
Another all machine language game based on the principle that one person with one joystick guiding one catch/shield can catch everything that one alien can throw at one. The action comes slowly at first but by the fourth wave you'll be aware of . . . "The Catch" . . .

Expanded Memory Vic 20 Games

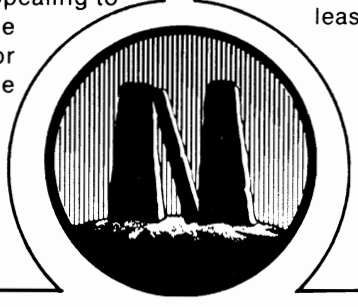
(CG090) Defender On Tri $19.95
Pilot a defender style ship on mission to save trapped scientists from a fiery fate (they are aboard an alien vessel deep in the gravity well of sol). Excellent graphics. Short scene setting story in the instructions. "Defender On Tri" requires at least 3K added memory.

(CG092) 3D Man $19.95
The maze from probably the most popular arcade game ever, with perspective altered from overhead to eye level. The dots, the monsters, the power dots, the side exits, the game is amazing. "3D Man" requires at least 3K added memory.

(CG088) Space Quest $19.95
Our first 8K memory expander game and its a beauty. The scene (a short story is included) is far in the future, a time when man's knowledge has reduced an entire galaxy into a mapped series of quadrants. This game has stratagy (you plot your own hyperspace jumps on Galaxy map), action (against a starry background you find yourself engaged in a dogfight, laser style), exploration (you must fly your ship deep into caverns to pick up necessary fuel). "Space Quest" requires at least 8K memory expansion and a joystick.

Commodore 64

(CG602) 3D-64, Man $19.95
This available on the expanded "Vic 20" game, has been completely rewritten for the 64 and uses sprites, sounds, and other features not available on the "Vic". This one requires a joystick.



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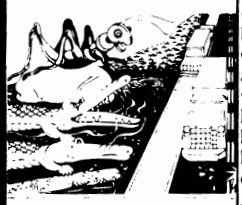

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CRICKET - From the company that brought you Asteroidz, Munchman and a host of other blockbusters. We now present CRICKET. This is a challenging game with a cast of characters you will love and hate. All you have to do is get Cherp from one side of the road to the river and then across the river. Not so fast though. First you have to figure out how to dodge the traffic and get to the center. Then how are you going to get across the river? Look here comes a log — even a turtle. Hitch a ride across the river and jump from one to the other. Keep a sharp eye out for Ade the Gator. He loves to have crickets for lunch. How many times can you get across the road and river. You will have to work as fast as you can. Time limit and bonus. You will find this game addictive and challenging and it will entertain you with hours of fun and enjoyment. **$14.95**

PARATROOPER

BUG BLAST - If you think Centipede was fun — look out for BUG BLAST. A new and fast action arcade game with realistic smooth action, quality hi-res graphics and trouble. Its very calm as the first wave attacks. Only a few bugs to kill. Just shoot thru the cactus and wipe them out. After a few attacks you feel you have everything under control. Now the attacks really start. Those protection areas have to go. Blast away. Will they ever stop? OK — the BUGS got me this time. Now its my turn, Just one more time — BUG BLAST — Now its your turn to get even. **$14.95**

BOMB'S AWAY - Can you stop him? The crazy bomber drops the bombs from the top of the screen. You get 3 buckets to catch them. Before you know it bombs are falling so fast you wonder when he will stop. Just when you think you have him under control your bucket gets smaller. Is your hand quicker than your eye? **Special $9.95**

PARATROOPER - You are the only one left to stop them. The sky is full of enemy choppers. Paratroopers keep dropping into your area with non-stop barrage of enemy troops. They are out to destroy you. This new game is an unbeatable blend of arcade action and quick thinking strategy. You must make every shot count — don't be to fast on the trigger. Every time you hit a chopper or paratrooper you get extra points. Wait until you see the climax of this game — you won't believe it! This is a multiple skill level game with razor-sharp graphics and sound. **$19.95**

MOW

MOW - Get ready for the fast and furious action of the craziest mower you have ever seen. How much grass can you cut? Joystick moves your mower around as fast as you dare. Watch out for granny's dafodils and grandpa's radio antenna. **$12.95**

COSMIC CRUZER - Bring the coin-op game into your VIC. 3 Scenarios. Your Cruzer moves over a mountainous landscape & into a tunnel of surface - to - air missle, silos and ground - to - air weapons. If you can make it in and out of the tunnel you fly into the asteroid field. Drop bombs and fire missiles at the fuel dumps to keep your fuel supply up. If you are really good you can get to the base and try, to destroy it. We don't know of any one that has hit the base yet. Maybe you will be the 1st. Cosmic Cruzer is a fun filled magnificently rendered home video game that will last for months of challenge. Highly addicting. Hi-Res Graphics, Color & Sound. **$19.95**

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SPACE PAK - Can you survive? 3 space games with the sights and sounds of arcade games. The excitement builds as the action is un-ending. Blast away at everything in sight. The alien attacks will stop at nothing to destroy you. Prepare for battle, there is no escape, unless you can help. Can you survive? Hi-Res, Color, Graphic & Sound. Joystick or keyboard. **$19.95**

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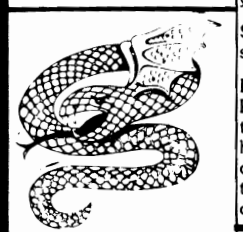
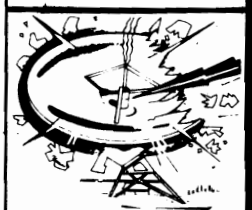


SNAKE OUT

SNAKEOUT - Slip your snake into position and score by chomping the blocks. Watch the way you slither because your escape routes get smaller. 2 Bonus games included. **$12.95**

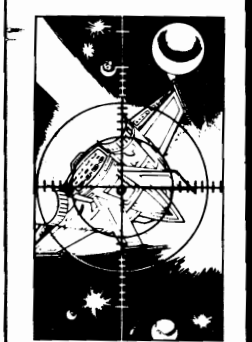
HEAD-ON - Please do not buy this game if you are the type that says "I'll play it just one more time". Players have been known to start playing HEAD ON at 8:30 p.m. and at 2 a.m., wonder where the time went? Have you ever tried to explain to someone why you played a game for five and a half hours. We know of no remedy for the addiction to HEAD ON except to beat the VIC on level 9. No one has done it, YET, will you? We think not. Move your car as fast as you can dare around the tracks. You get 3 cars and MUST avoid the computer car. Points for the most dots covered. Bonus cars, nine levels of play. **$12.95**

BUG BLAST

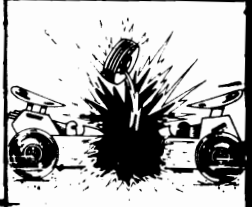


TARGET COMMAND

COSMIC CRUZER



SPACE PAK



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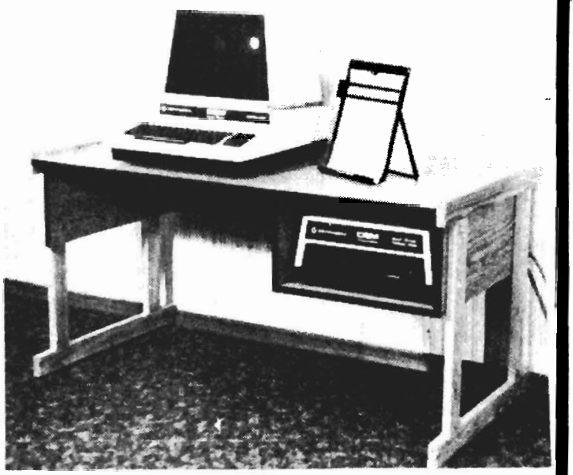

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FEATURE

MAKING FRIENDS WITH SID

by Paul Higginbottom
Toronto

PART I

The synthesizer chip in your Commodore 64 computer is affectionately known as Sid. Sid is in fact an acronym for Sound Interface Device. I doubt that many people realise just how powerful this chip is, but I intend to unleash some of its power for you. If you read some of the documentation for the Commodore-64 about its sound capabilities and are new to (as I was) synthesizer jargon, you probably thought to yourself, "I'm never going to figure that out!" Well, I am the sort of person who gets more determined to figure something out, when it seems harder than ever to do so. So, step by step, I, like any beginner, set about learning how to control the Sid's sound capability.

The Jargon

If your mind is like mine and tends to go blank when confronted with a barrage of alien jargon about something, then hopefully I can gently "break you in" with the terms associated with music synthesis using Sid.

The Sid chip is comprised of three sections essentially:

1)Oscillator section
2)Envelope section
3)Filter section

There are a few other bits and pieces, but more on those later.

Sid has three **voices**. That means to you and me, that up to three tones can be played at the same time.

Each voice is separately controlled by its **frequency** (the pitch of the tone), and more importantly, its **envelope**.

The envelope of a voice, determines how its volume rises, sustains, and falls, like a musical instrument, or other sounds we hear in our lives. For example, a violinist, will maybe play a note by pulling the bow across a string slowly at first (the volume starting out low), and as the player starts to increase the speed and pressure of the bow on the string, so the volume increases, and as the player ends the note, he or she slows the rate and pressure of the bow again, and the volume fades away to silence. With a single violinist, the tone may fade away rather abruptly, but I'm sure you've heard this rising and falling effect of volume, with a piece of orchestration (many string instruments). That is one example of an envelope. If we consider another example to allow you to grasp different types, think of hitting a cymbal. The rise to its maximum volume is almost instant, as the CRASH of the cymbal begins, and from that point, the sound simply fades away slowly to silence again. An example of a cymbal type of sound that does rise slowly first and then fade away would be a wave approaching the beach. You hear the slowly increasing volume of the wave moving up the beach, then as the wave trips over itself and hits the beach the loudest part of the noise is heard, and then the sound fades away as the wave slides up the beach, and the next one approaches again.

Well, enough of the examples, back to the technical stuff. This "behaviour" of the volume (or amplitude) of a voice, can be defined in 4 parts, and this terminology is common amongst professional synthesizers costing many times the prices of your Commodore-64 computer!

The four parts of an envelope

You may have noticed by now, that to define this changing in volume, we simply need to define the TIME it takes for a sound to go from one volume, to get to another volume. For example, the violin might have taken half a second to go from no volume (silence) to its maximum volume,

and then 2 seconds to fade away again (silence again). The cymbal took no time to reach its maximum volume (starts with the CRASH), but 10 seconds to fade away. The wave is different again, in that it might take 5 or so seconds to build up to maximum volume (as it moves up the beach), and then only 1 second to die away (as the wave falls over and crashes on the beach).

Part 1 - ATTACK - This is the time taken to go from silence (0 volume) to the maximum volume Sid is set to.

Part 2 - DECAY - This is the time taken to go from the maximum volume Sid is set to, to a given "mid-point" volume, or: sustained level of volume.

Part 3 - SUSTAIN - This is not a time value, but is a level of volume the voice sustains at after the ATTACK and DECAY.

Part 4 - RELEASE - This is the time taken to go from the sustained volume to silence once again.

In those definitions, I mentioned "the maximum volume Sid is set to", and that is the maximum overall volume (just like the overall volume control on your television or stereo).

How we control Sid

Before I go any further, I want to explain how we actually tell Sid exactly what weird and wonderful sounds we want it to make (so we can drive everyone crazy!)

The Sid chip has an amount of memory in it, and simply by putting numbers into those memories, we give Sid all the information it needs to produce an infinite number of sounds. We put numbers into memories with the BASIC command **POKE**. We give the poke command two numbers; the memory number (or 'address'), and the number we want to put into that memory (one memory location can hold any whole number between 0 and 255).

Sids address is quite a big number. He starts at 54272, and he occupies that memory location and the next 28 also, up to 54300.

I want to show that it really is **not** that difficult to train Sid, and that you **don't** have to be a genius at programming.

Making your first beep

To make a noise, we must do 4 things:

1)Set the maximum overall volume

2)Set the envelope of the voice we wish to use

3)Set the frequency of the voice to the desired pitch

4)And only then 'tell' Sid to do it.

I put quotes around 'tell' in part 4, because I want to examine that closer. When we tell Sid to make a sound, we tell it to firstly do the ATTACK (rise up to maximum volume) and then the DECAY (go down) to a SUSTAINed level of volume. When we tell Sid to do that part, the noise will stay at the SUSTAINed level of volume forever if you don't tell it to go on, and do the last part; the RELEASE (go down from the sustained level of volume, to nothing).

So to recap, we tell Sid to do the ATTACK-DECAY-SUSTAIN part first, and then when we're ready, we tell it to finish the envelope with the RELEASE part.

You could get a person to demonstrate this for you. Ask them to take a DEEP breath when you tap them on the shoulder and then hum a note at first quietly building up to a loud level, and the going down to a comfortable level. You have made a person do the Attack-Decay-Sustain part of an envelope. I said the sound will continue indefinitely if you don't tell it to release, so when you tap the person again on the shoulder, they can slowly quieten their hum down to nothing. Of course if you decide to make them sustain for too long, they'll go blue in the face, and pass out! Also you may want them to stop before they get to the release, because their hum is so obnoxious! (Fortunately, you can also do this with the Commodore-64!)

For now, let's just concentrate on ONE voice. Each voice has 7 memories inside Sid, to control it. Voice 1's memories are in fact, the first 7 memories, voice 2, the second 7, and voice 3, the next 7. That, if you've been doing your math, is the first 21 memories in Sid. The other 8 (there are 29 in all) are for the filter section which I haven't talked about yet, and other bits and pieces, including the overall volume control which I have mentioned).

The 7 memories for each voice are all organized the same way, for example, the first two of each block of 7, control the frequency (pitch) of the voice.

The 7 memories for a voice

The first two as I just mentioned, control the frequency of the voice, that is, the pitch of the sound.

The second two are to control one particular type of sound, which will be covered later

The fifth memory is the controlling memory of the voice, the one which will tell Sid to start the note, stop it, and choose the type of sound.

The sixth memory controls the duration of the Attack and Decay.

The seventh memory controls the Sustain level, and the Release time.

The fifth of the seven I just described, I will now explain further. I mentioned there that apart from telling Sid to play the envelope, it also controls the **type** of sound. (Another piece of jargon coming up!) The type of sound is known as the **Waveform**. You are probably aware that sound is comprised of air being compressed and stretched. By, for example, a speaker cone, which moves in and out, and the speed (the FREQUENCY) at which it moves in and out, determines the pitch.

The way in which air is compressed and stretched is cyclic (repeats itself), and this cycle is known as the waveform.

Sid allows you to choose from one of four waveforms, and it is the fifth of the seven memories in each voice, which you set to tell Sid which waveform you wish to use.

The Waveforms

Triangular (shaped like this: ) This waveform, due its smoothness produces a mellow, soft flute-like sound (very pleasant to the ear!)

Sawtooth (shaped like this: ) This waveform, due to its abrupt ending produces a brighter, brass-like sound.

Variable width pulse (shaped anything from this:  , to this:  , or this:  [which if you look is simply the first one upside-down]) This waveform as you can see from the description in parenthesese can be varied, but is essentially an ON and OFF waveform, and as such is very abrupt and produces anything from a hollow, organ-like sound, to a very quiet, reedy sound. As you can see from the symbols of this waveform, it is comprised of pulse, or varying widths (hence the name), and memories 2 and 3 which I mentioned earlier were for a specific type of sound, do in fact control the width of the pulse when this waveform is chosen. Of course, memories 2 and 3 have no effect when any other waveform is selected.

Noise - I won't try to do a little drawing of this waveform, since it is in fact a RANDOM waveform, and has no defined harmonic qualities, but because the frequency can be altered, will produce any sound from a hiss (like you hear from poor quality cassette recorders), to a low rumble (good for special effects in games).

Please note the format of the memory locations used. I mentioned that the first TWO bytes are used to select the frequency, but did not say how one would know what values to put in one and the other. The easiest way to look at it, I would expect would be thus:

Since one memory location can only contain a number from 0 to 255, to

represent larger numbers, they are stored as 0 to 255 in the first byte (known as the **low** byte), and multiples of 256 added to this in the second byte (known as the **high** byte), which means two bytes can hold a number from 0 (0 in both locations), to 65535 (255 in the first one, plus, 255 times 256 in the second one).

The ATTACK-DECAY memory, and the SUSTAIN-RELEASE memory are comprised as follows:

The ATTACK, DECAY, SUSTAIN, RELEASE parameters can all be one of 0 to 15. To form the ATTACK-DECAY value for memory location 6 in a voices 7 memory locations, simply multiply the ATTACK by 16 and add the DECAY value. This again gives a combined value from 0 (0*16+0) to 255 (15*16+15).

The control register works differently still. The value is calculated as follows:

Add 1 to begin Attack-Decay-Sustain cycle; don't add 1 to begin the Release cycle.

Add 16 to select triangular wave form, 32 for sawtooth, 64 for variable width pulse, or 128 for noise waveform.

There are other parts to add to this value, but they won't be covered here.

The beep program

Turn on your Commodore-64, and type in the following program:

```
10 SID  54272
20 FOR I=TO 28:POKE SID+1.0:NEXT
30 POKE SID+24,15
40 POKE SID+1,20
50 POKE SID+5,0*16+0
60 POKE SID+6,15*16+9
70 POKE SID+4,1+16
80 POKE SID+4,16
```

Description of the program

Line 10 defines a variable SID, to the start of Sid's memory locations.

Line 20 should be included in all of your sound programs, and is a FOR..NEXT loop to simply set all of Sid's memory locations to 0 to ensure that no previous programs will affect our efforts.

Line 30 sets memory location 24 in Sid, to 15. Register 24 controls the overall volume of Sid (and some other things which need not be known here), and 15 is the maximum volume (from 0 to 15).

Line 40 sets the upper byte of the frequency value of voice 1 to 20, which means a setting of 0+20*256=5120.

Line 50 sets the ATTACK value of voice 1 to 0, and the DECAY value also to 0, which means when we tell Sid to do its ATTACK-DECAY-SUSTAIN cycle, it will simply go straight to the SUSTAIN volume, since we've told it not to do any ATTACK or DECAY at all.

Line 60 sets the SUSTAIN value of voice 1 to 15 (maximum volume), and the RELEASE value also to 9, which means when we tell Sid to do its RELEASE cycle, it will take about three quarters of a second to fade away to nothing.

Line 70 sets the control register of voice 1 to do the Attack-Decay-Sustain sequence, with the triangular waveform selected (+16).

Line 80 sets the control register of voice 1 to do the Release part of the envelope, again with the triangular waveform selected (+16).

Having typed in this program, type:
RUN
And the familiar:
READY.

Message will come back almost immediately, with the mellow sound fading away (provided you have the volume control on your television set up reasonably high so you can hear it!)

Well, there's a LOT of new things for you to absorb in this article before we can go on to further things. We've only done a PING so far, but we'll have Sid playing Bach soon enough (or maybe a little Genesis?)

Cont'd next issue

COMMODORE-64

Synthy—64 by Bill Cook

Reprint from CHUG Houston, Texas

Synthy-64, written by Roy Wainwright and sold through Abacus Software, is an entirely new language which is surprisingly easy and fun to use.

It allows all BASIC commands while in the direct mode so programs can be saved or loaded from tape or disk and listed to the printer. The language is extremely simple yet very complete.

Here is an example of a simple music program using the Synthy-64. It will play the "C" scale:

```
1 Run "<clear>" ; This line may not
be omitted.
5 T120 ; Sets tempo to 120
10 SGN 0 ; Key signature for
"C" scale
15 C5/4 D/8 E F G A6 B C/4 ; Upscale
20 B8 A G5 F E D C/4 ; Down scale
25 END
```

For some reason, line 1 cannot be omitted. Line 5 sets the tempo which is adjustable from 15-255. Line 10 sets the musical key to the Key of C. The "#0" means we have selected zero sharps (% =flats, $=naturals. Line 15 starts upscale. The "C5" tells Synthy-64 to play the note "C" in the 5th Octave. The "4" after the / tells the program to play a quarter note. After inital setting of the octave and note duration; neither needs futher mentioning until they need changing.

Synthy-64 allows repeating of stanzas by using the "[n", and "]n" notation. Thus:

```
15 [2 C5/4 D/8 E F G] A6 B C/4
```

This repeats the notes in brackets twice (i.e. play three repetitions) as indicated by the "2" after the "[".

Be warned that Synthy-64 uses only one time signature (4/4), but it is claimed that with careful use of the tempo (T) command, this technicality might be somewhat alleviated.

The program does not use measures for composing music. The "T" command can be halved or doubled to change which note value gets one beat. Programming music without measures on the Synthy-64 is favored by some who believe it makes their composing task easier.

Synthy-64 allows the tieing of two notes together by using the backarrow symbol (abbreviated here as 'ba'):

```
25 C5/4 'b' D/8 'b' E 'b' F 'b' G 'b' A6
'b' 8 'b' C4
```

This will slur the notes upscale. Note that the duration is limited up to 64th notes.

Synthy-64 also has many note duration modifiers. For instance a period following a note indicated a dotted note, for double dotted notes use semi-colons, and for triplets use an exclamation mark.

```
25 C5/4. D/8: E/4! F/4! G/4! A6/8 B C/4
```

This will play a dotted quarter note, a double dotted eigth note, three triplets, two eigth notes (normal) and one quarter note (normal).

A rest is indicated by a 'R/' follwed by a number to indicate the duration. Perhaps the most exciting feature of Synthy-64 is the three-voice mode. The prefixes "+" , "-" and <British Pound sign (bp) are used to indicate which voice is to play which note. Also, Synthy-64 keeps looking ahead to see if it can play notes for any other voice.

```
25 +C5/2 -E5/2 bp65/2 +D -F bpA6 +E -6
bpB
```

This will play three chords (C Major, D Minor, and E Minor).

Synthy-64 also has a "TRACE" feature which allows display of each voice as it is being played; a visible music monitor.

Synthy-64 lets you print to the screen,

input information, and even offers five user callable instruments. It has easy setting of waveforms, AD/SR, and other features not found in the users manual such as the ring modulators and the resonance registers.

My only disappointment was that I could find no way to set the low pulse for the variable pulse waveform; only the high pulse.

I **STRONGLY** recommend Synthy-64 to all CBM-64 owners. It makes making music fun and easy. The instruction manual was very, Very, VERY good; Synth-64 can help you get better acquanted with CBM-64's SID system.

TPUG Central Meeting

Apr. 1983

by I.A. Wright
Toronto

The April meeting started at 7.45 p.m. with some introductory remarks by our President Mike Bonnycastle. At an earlier meeting, one of the club members wanted to know if others shared his interest in HAM radio and the computer. They do, but we have lost track of him. If you are the person, or if you are interested, please give your name, address and phone number to the club office. The phone number is 782-9252.

Gord Campbell spoke about the TPUG conference to be held at the Casa Loma Campus of George Brown College. (note that there's no May Central meeting) There is a need for 4040 drives to allow for the copy-session. (follow the example of one member who offered four!) If you can help, please phone Bill O'Brien's answering service (in operation 24 hrs a day) at 445-5209. The entire C-64 library will be available at the copy session as part of a total of 30-40 disk-masters for copying. The hours of the Conference will be 11:00 a.m. to 6:00 p.m. on Saturday May 14, and 11:00 a.m. to 5:00 p.m. on Sunday May 15.

Al Farquharson then made a pitch for people to help in introducing and thanking guest speakers. We have some very high profile presentations and need to show these visitors a proper Toronto welcome. If you can volunteer to introduce one speaker it will require only about an hour and leave lots of time for the rest of the show. Al also suggested that some help would be appreciated in manning the registration desk.

Dave Williams asked that anyone who is interested in setting up a booth in the "Traders Corner" contact him ASAP so that sufficient area can be set aside for this activity.

Mike Bonnycastle now took back the microphone to explain that the judging for the TPUG Programming contest was running into difficulty. Mike explained that the club has received 40-45 entries and that some disks had 5 or more programs on them. Another problem area was that some programs were incompatible with the available machinery. For example there were programs written in Waterloo Basic. The judging continues....

Commodore Canada is in need of full-time, year 'round programmers according to Frank Winter of Commodore. Any interested persons should send a curriculum vitae or resume to Frank at the plant in Scarborough.

We had about 50 new-comers at this Central meeting, and despite the break-away of the VIC and C-64 groups, the auditorium was at least two-thirds full by this time. When I arrived I checked my calendar because the parking lot was almost deserted (6:55). By 7:30 I was told that the only parking was on the neighbourhood streets. I think that this is an indication that the PET series of machines still has a lot to offer.

Our first presentation was of Story Writer by Joe Vayda and Chris Capon. A review of this exceptional program is in last month's TORPET. Joe explained that the program resulted from runaway tricycles since the

CLUB ACTIVITIES

Kindergarten class (next door) drove in and wanted to write stories just like their big brothers and sisters. The programmer, Chris, has spent about 350 hours assembling and perfecting this program from a BASIC original done by a grade 6 pupil. (these student programmers never cease to amaze me!) Joe explained that a senior version will hopefully be available in the near future.

Jim Butterfield introduced his cohort Jack Livesley from the TV-Ontario series "The Academy". We were then treated to the Jack and Jim show with a routine on the dangers of small robots that are incorrectly programmed. It seems that, while taping a show that used a Heathkit HERO (looks just like R2D2), Jack was attacked by the extended manipulator arm. He moved rapidly away and thus was saved from being turned into Jackeline!

Jim showed his mortgage program as a demonstration of compatability among Commodore machines. You are asked to input a number of variables such as the term and rate and enter a question mark against the one that you wish to be computed. You can thus manipulate the information and receive a schedule of payments with a machine language dump of the screen to a printer. Note that the mortgage is calculated semi-annually (Canadian rules).

There is a need for a universal loader so that C-64 and VIC programs (in BASIC) can be adapted to load into the PET. The program is called PROG CONVERTER.Z on the April disk. Line 270 checks that the program is not written in machine language by checking that the first address is CHR$(1). The program then re-writes the first location as CHR$(4) - 0401, and then calls SYS 828 to copy the remainder using a short machine language program. Loading relocates and rebuilds the remainder of any program. Jim's next trick was to deliberately crash a PET showing the need for correct starting link addresses.

After break we were shown a version of LISTER (not on the April disk) that writes out cursor controls etc. when listing a program to a printer. New versions will be available soon to allow listing the colours and controls of the VIC and C-64. Although the BASIC program is slow, a compiled version may be available also.

Skeet is an example of animation in basic using strings to control the movement of the pigeon, bullet and the hit. T$(1) and T$(3) are examples of the strings required to draw a pigeon, replace it and re-draw it at another screen location. Although we often think of basic as being slow, this program showed that success required considerable hand-eye coordination and that most things happen fast enough in a microcomputer. Jim suggested that we not be "hustled" into 16 or 32-bit processors because they are faster. The printer, the disk-drive, the screen, and even the human body can only work so fast. Most of the delay in computing occurs while we read or write to an external device. Timing isn't everything.

One of the club-members asked Jim how one might read the "Blocks Free" from within a program. By loading a dummy title using OPEN1,8,0:LOAD"$0:asfdhd!#",8:LIST: the result will be the title plus the blocks free. It is possible to draw out the required bytes ... but messy. Another member asked how to check status using two disk drives. Jim's suggestion was to open two error channels and read the one required. e.g. OPEN15,8,15:OPEN16,9,15: then read #15 or #16.

Chris Siebenmann attempted to show some machine language utilities that do things that basic does slowly or not well. Unfortunately, the 8032 machine was missing, Chris had difficulty finding his materials, and the presentation on an unfamiliar machine led to a lock-up of the set. Maybe Chris will write it up for the TORPET?

Mike Donnegan asked for more program submissions from the Toronto members, and pointed out that there were some last minute additions to the monthly disk that didn't make the List me file. Brad Templeton asked for suggestions for additional routines for the C-64 ROM version of Power.

See you at the conference!

Hardware Hacker

by Hank Mroczkowski

Houston, Texas

WAYNE beat me to the punch and I'm **GREEN** with envy! A few months ago, I mentioned the dire need for a "breakout box" for any RS-232 interface problems we may be encountering. Well, you'll find an excellent article describing just that in the March issue of Wayne Green's Kilobaud, er, Microcomputing, page 108. (I still like the old name better).

Mr. George Ewing has written about a breakout box which he calls the Super Tweenie. I highly recommend that those of you who are using more than one RS-232 device, or plan on using more, or are just having problems trying to get a printer which has an RS-232 input to operate properly, promptly, beg, buy, borrow or steal this issue. The construction isn't beyond anyone's means nor capabilities...do it! It even allows you to jumper it as a null modem and permanently leave it in your system. (The null modem cross connects the wires of two terminals to let them talk to each other...inputs are connected to outputs and not to each other, etc.) See the past Hardware Hacker columns for more information. There's just too much to re-explain every time RS-232 is mentioned. Mr. Ewing lists a full 25 pin chart of the typical configuration of signals and where each of those signals comes from (source)....good reference.

By the way, since I can't let sleeping dogs lay, (did I get that right?) my version of the breakout box would have used a barrier strip, a hand full of spade lugs and an existing RS-232 cable. Cut the cable in half, strip back the sheath of expose the color coded wire and attach the lugs to each wire end. The tricky part is identification of each color to each pin number of the DB-25 connector. Use a test light or an ohm meter and write it down as you go. Fasten one set of wires and lugs to the barrier strip...the other set can be connected as a null modem or an X-line to 3-line or simply pin-for-pin through connection which provides easy access for measurements to each wire. If you treat it gently, there is no need to do anything else to your barrier strip. Otherwise mount it on a pine board or under your console and clamp the cables for strain relief. Done! (Read KB's article for more information.)

GOSUB

INTERNATIONAL INCORPORATED

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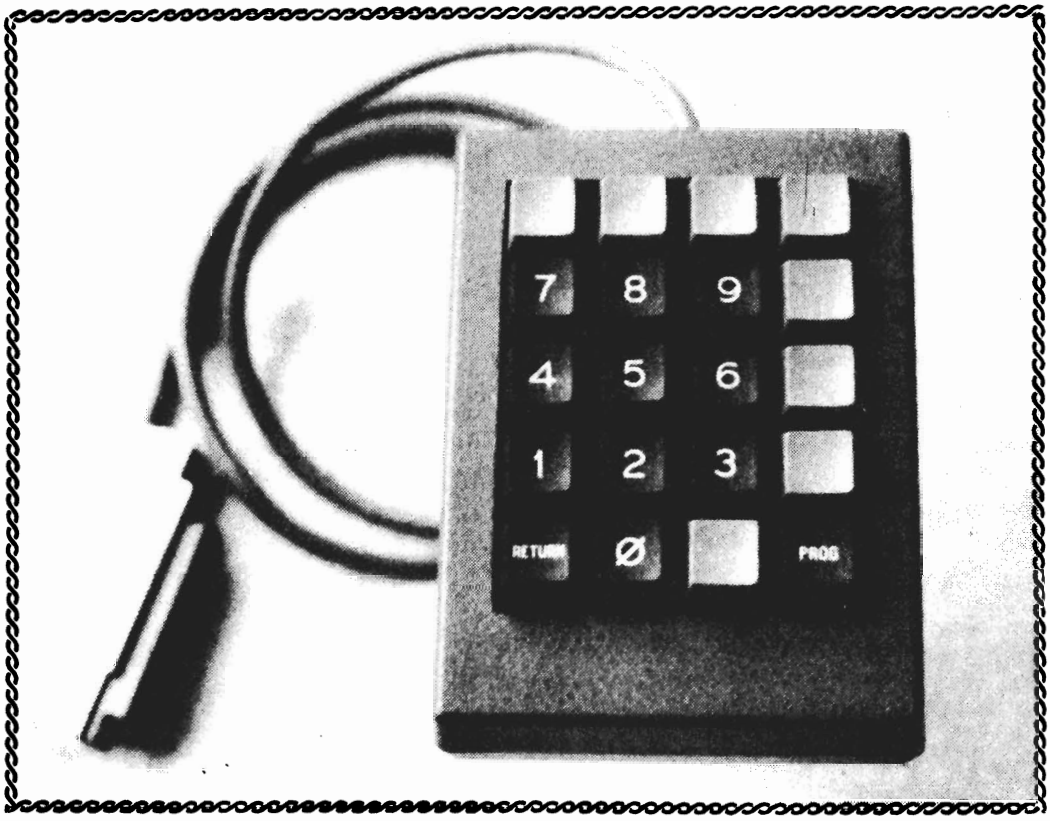
The Flexikey System



The Flexikey System consists of a 20 key auxiliary keyboard and driver software. Each key, except for the PROG key has three values or faces. The Flexikey Driver is written in easy to follow Basic. Two drivers are provides, one for the expanded VIC 20 and one for the C-64 computer.

When the Flexikey Syatem is in operation, its Driver software will use only 330 bytes taken from the top of the available RAM. This 330 bytes consists of a 100 byte table and 230 bytes of initialization routines and the actual Wedge that drives the Flexikey System.

The primary objective in the design of the Flexikey System is to enhance the data entry capability of the Commodore's CPU. Since we can not forsee the type of data entry required by each user, we elected to allow the user to design his or her own key definition.

Two modes of operation are provided, each of which allow 19 of the 20 keys to be defined as any single key on the Commodore keyboard. The 20th key, the PROG key, allows switching back and forth between these two primary modes at any time. Once switched, the mode that was switched to will remain in effect until switched again. The switch is executed by pressing the PROG key twice in succession.

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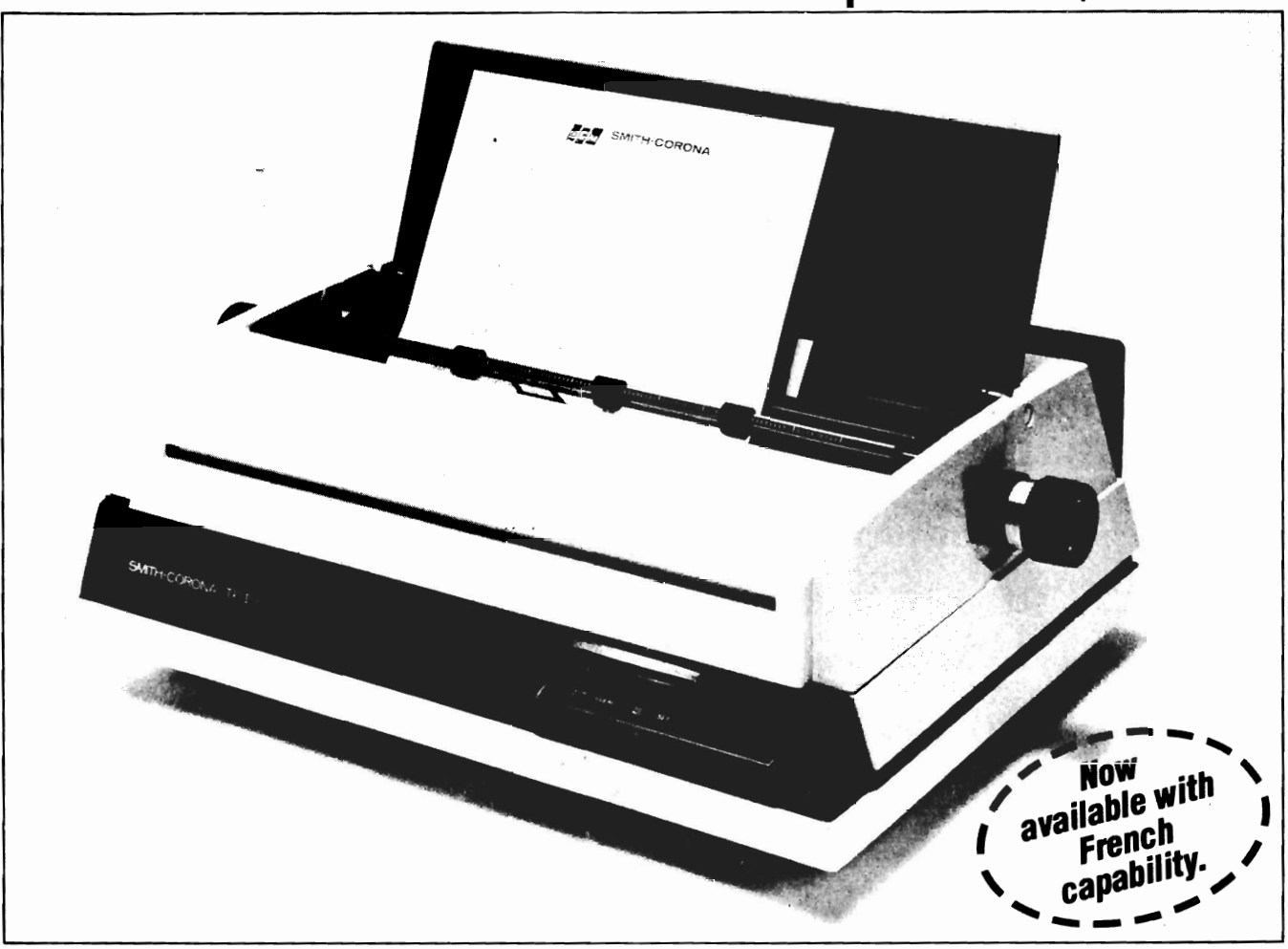

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T

Loading C–64 Programs into the PET

by Elizabeth Deal Malvern, Pa.

Since the VIC and the Commodore 64 appeared on the scene, there seems to exist an epidemic of the need to load their programs into the PET. Several ways have been proposed, most assume that the programs will load in at $0801 (2049 decimal). Some methods I have seen require several nasty POKEs and, to make matters worse, require knowing where the program came from. I found myself continually creating C-64 partitions on the PET and hunting for programs, until one day it dawned on me that the solution was staring me right in the face.

Generally, it involves using some sort of a toolkit program or the tape or disk MERGE methods of Brad Templeton and Jim Butterfield. These types of programs are relocators by definition. XEC command of POWER does the job for you. If you don't have POWER, see R. West's Programming the PET/CBM for the merge methods. The disk Merge command was described in Transactor #8.

By far, the easiest thing is to use the toolkit-type commands after typing NEW in the PET.

1. TOOLKIT has an APPEND command. TOOLKIT will append to nothing, ultimately relocating a C-64 program to wherever you are in the PET.

2. BASIC AID has a MERGE command. It, too, should merge with nothing and relocate.

3. POWAID, which is Brad Templeton's extension of his POWER chip, contains a MERGE command. MERGE"0:C64 PROGRAM moves it exactly where you want it.

4. I'm sure other similar utilities on chip or in RAM will do the same thing.

There is a related issue, that of moving PET programs into the C-64. I wrote several at $4000 (16384) on the PET and saved them via the ML monitor from $4000 (It's a nice, even number!). I thought the C-64 would relocate correctly. Well, it did, but I botched the job. I ended up with a horrendous mess of crazy line numbers. The C-64 moved the initial zero, of course. So, the moral of this story is not to save the initial BASIC zero. In contrast to PET, a program in a PET partition at $4000 should be saved from $4001 if the intent is to move it to the C-64. Of course, using the LOAD"PET PROGRAM",8,1 does the trick on a $4000-type save if you can remember the ",1" part...

GENERAL

HARDWARE WORKSHOP

by Greg Harrison

Waterloo, Ontario

The WATCOM Computer Hardware Digital and Interfacing Techniques workshop is a three day, intensive, hands-on study of digital computer circuits. I enrolled in the course and spent three valuable days learning many concepts in digital electronics. The stated course of study included.

1. Memory and decoding circuits
2. Data output
3. Data input
4. General I/O chips
5. Digital-Analogue Conversion
6. Analogue-Digital Conversion
7. Computer control of high voltage

THE WORKSHOP

The workshop is given by a group called "Watcom Seminars", formerly "Watsoft Products Inc.", the same people who produced Structured BASIC. The lectures were given by D. D. Cowan, Peter Ponzo, Ray Cote and Jim Allen. Twenty-six experiments are described in the course laboratory manual. They explained, even to an electronic neophyte like me, how to wire the circuits, their purpose and the underlying principles of their operation.

In addition to the stated objectives of the course I also gained familiarity with the technical jargon and terms that have been a block to my learning the topic on my own. The meaning of TTL and CMOS technology; how to read a "pin-out"; techniques for debugging circuits; and a general feeling of confidence in reading about digital circuits were all small, but important skills gained.

EQUIPMENT

Each of the twenty participants is supplied with a 2001 PET wired to a trainer board, (more about the board later), a very complete set of notes which explain the lectures in detail, a lab-manual of 26 experiments, and a supply of all the IC's, discrete components, wires, switches, displays, and tools to perform the experiments. Also available in the room is an extra logic probe for testing the circuits, voltmeters -and additional tools if required.

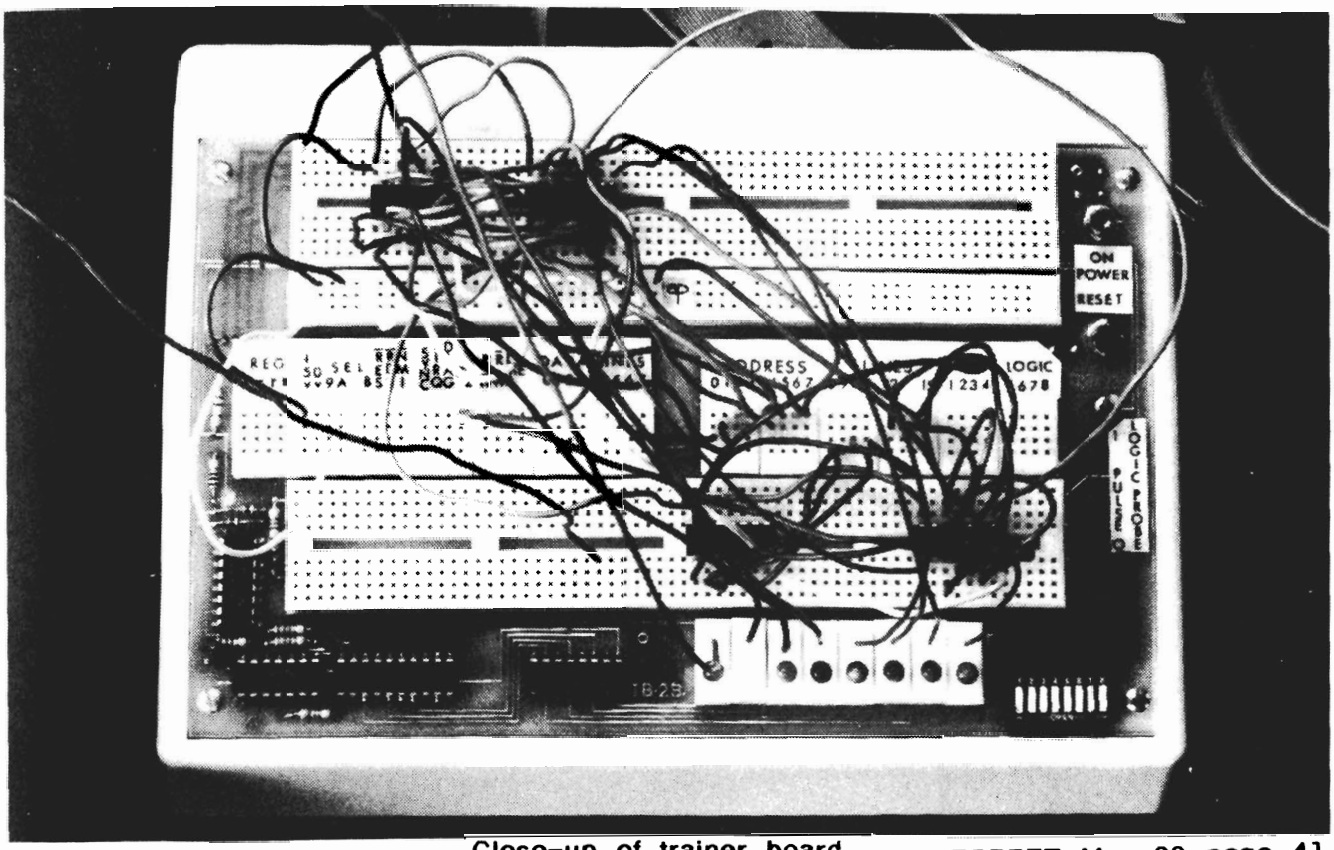
Programs that run on the PETs to test the circuits we built were supplied on tape so that they did not have to be typed in. The programs were also listed in the manual with the respective experiments. I tended to type them in myself and make a few improvements to the screen output, but the ones supplied were adequate.

EXPERIMENTS

The experiments are created to explain much of the internal functioning of a microcomputer. Although the 6502 microprocessor, and the PET are used to interact with the circuits that are developed, the concepts are applicable to any computer. The knowledge that is presented is general and would be easily transferred to other devices as well. The lab-manual is organized into seven sections, each designed to explain a different aspect of computer processing. Within each section there are a series of experiments to be wired and tested. The task, at first glance, seemed overwhelming. However, the experiments in each section were similar to each other and when the first project was wired there were usually only slight modifications required to perform the others in the same section.

Each of the experiments that I attempted worked as expected, even though some had to be debugged and corrected. The practice of debugging the circuit was difficult at first since there seemed to be 'thousands of wires' and it was difficult to know where to begin. The instructors were very good at simplifying the process and I felt I learned important techniques through the debugging process.

PET wired to trainer board



Close-up of trainer board

The lab-manual was extremely well organized, easily understood, and contained all the necessary parts lists, diagrams, explanations and discussions of the circuits to facilitate the building of them.

THE TRAINER BOARD

Dr. Cowan created a very complete and easy-to-use trainer board on which we wired the circuits. The trainer interfaced with the PETs through the expansion interface port (the big one on the right side) and also connected to the empty ROM socket at $9000.

The board contained all the necessary connections to the 6502, including the read/write line, the phase 2 clock, the IRQ, all address lines and data bus. Hence all wiring to circuits down on the trainer were analogous to wiring internally to the PET.

The advantage in being connected to a PET was that we could test the circuits easily by running BASIC programs. Other trainer boards require you to learn a machine language to run any programs.

The board contained a built-in logic probe which proved useful for testing the circuits and contained protective circuits to prevent any 'frying' of the PET's internal parts. I found the board very easy to use and understand. It seemed well designed and well produced.

WHAT YOU SHOULD KNOW

My background is in programming and I had a fairly good knowledge of the theory of AND and OR gates, Boolean Algebra and Number Systems. But I had no background in electronics. Others in the course had excellent electronic knowledge but not the skills in the theory. It did not seem to matter. All the topics were covered in the lectures and were explained more fully in the notes. My suggestion to anyone planning to take the workshop would be to do some general reading beforehand so as to get the most out of the practical aspect of the course. At the completion of the three days you will be much more capable of learning on your own.

The course brochure recommends that you have a knowledge of at least one high level computer language such as BASIC, COBOL, or Fortran, but previous knowledge of electronic principles or experience with computer hardware is not necessary.

The cost of the course, which is aimed at commercial and government institutions is $600, although a substantial reduction exists for high school teachers.

Hardware workshop at Waterloo U.

CLUB ACTIVITIES

The TPUG Conference

by Gord Campbell

The TPUG Conference will be at the Casa Loma campus of George Brown College. Hours of operation are:

Saturday, May 14
11:00 a.m. to 6:00 p. m.
Sunday, May 15
11:00 a.m. to 5:00 p.m.

The conference will be free to TPUG members and their families. Visitors are welcome; the $10.00 admission fee may be applied to TPUG membership.

FOOD

The college cafeteria will be open during the conference, offering a selection of meals as well as coffee and snacks.

PRESENTATIONS

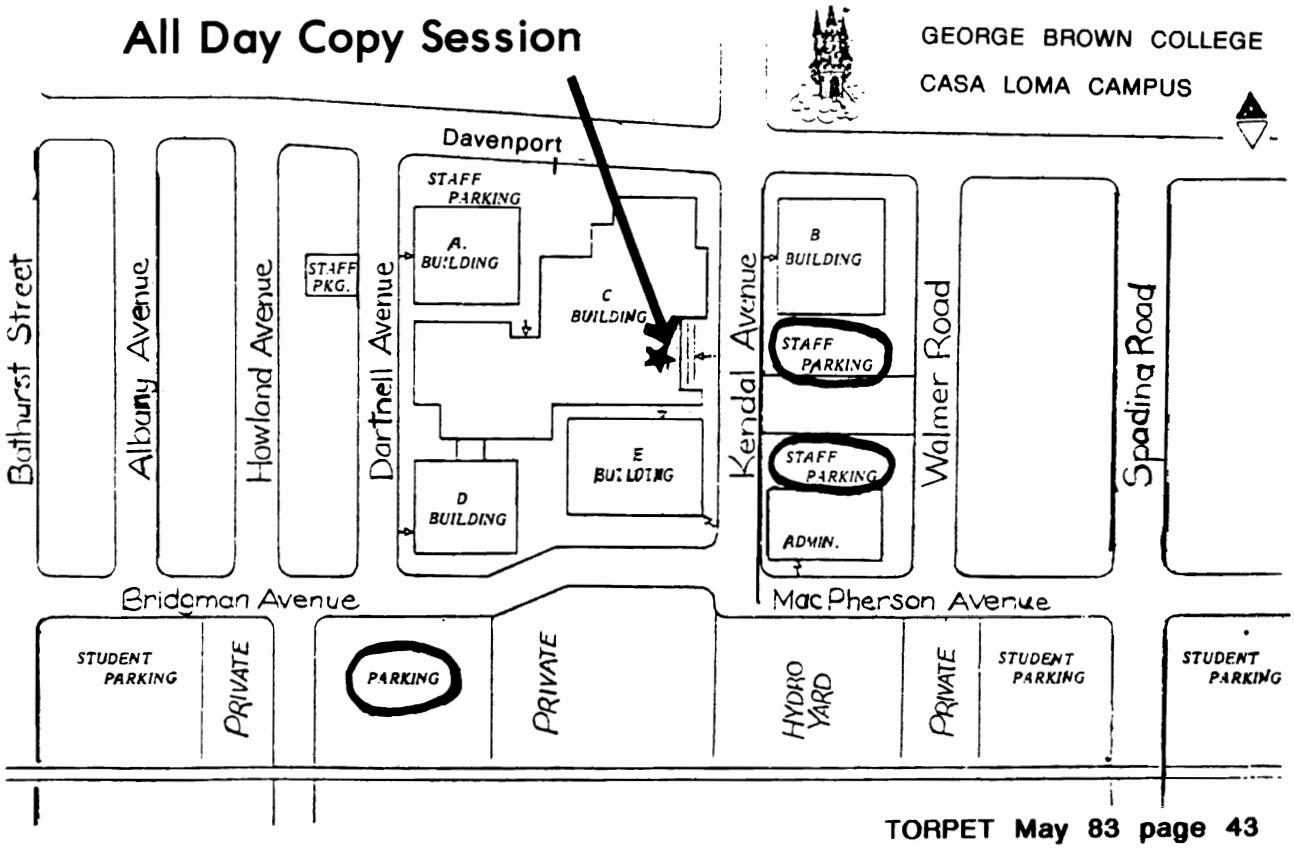
The schedule of speakers is presented elsewhere in this issue. Please note that it may be necessary to make some adjustments to the schedule between now and the conference.

DEALERS

A number of dealers have confirmed their plans to participate in the show, so don't forget to bring your credit cards and checkbooks.

TRADERS CORNER

The 'Traders Corner' will allow members to sell equipment which they no longer require. We don't know what the response will be, but expect some bargains in used equipment.



Conference Presentations

The planned schedule of presentations follows. It may be necessary to do some last-minute rescheduling, so a final schedule will be available at the registration desk.

Saturday, May 14

11:30 a.m.

Staff Lounge: **Greg Yob**
Gleanings from Greg's popular column in Creative Computing
Audience: all

Auditorium: **Willi Kusche**
Pascal on the Commodore 64
Audience: those interested in PASCAL or the '64

Room 238: **Bharat Shah**
Modeling with Visicalc
Audience: those interested in computer use for business or personal finance

Room 235: **Chris Siebenman**
Connecting Machine-language programs to BASIC
Audience: machine-language programmers

1:00 p.m.

Staff Lounge: **Keith Falkner**
BASIC programming: organize your data
Audience: beginning to advanced BASIC programmers

Auditorium: **Games Panel**
Favorite games on the PET and CBM
Audience: those interested in games

Room 238: **Jim Law**
Using files from Machine-language
Audience: machine-language programmers

Room 235: **Dr. Irving Koven**
Using the CBM in a small cancer clinic
Audience: those interested in computer use for business

2:30 p.m.

Staff Lounge: **Peter Spencer**
NOS Basicode: truly portable programs (supports PET, VIC, TRS-80, APPLE and many others)
Audience: all

Auditorium: **Games Panel**
Favorite games on the VIC and C64
Audience: those interested in games

Room 238: **David Williams**
Hardware interfacing on the user-port
Audience: would-be 'hardware hackers'

Room 235: **Dr. George Piasecki**
Using the CBM in a clinical environment
Audience: those interested in computer use for business

4:00 p.m.

Staff Lounge: **Loren Wright**
BASIC programming for beginners (From Loren's column in MICRO)
Audience: BASIC programmers

Auditorium: **Dr. Frank Covitz**
High-resolution graphics on the Commodore 64
Audience: people interested in the '64 or computer graphics

Room 238: **Gord Campbell**
Features of the new 'B' series machines
Audience: people interested in programming the B500

Room 235: **Al Farguharson**
Drill and diagnosis on the PET for preschool and trainable retarded
Audience: those interested in computer use in education

CLUB ACTIVITIES

Machine Language Seminar

Jim Butterfield's Introduction to Machine-language seminar will run from 11:00 to 5:00 on the Saturday. This session has been filled by pre-registration. It will be held in room 426.

Machine Language Seminar

Sunday, May 15

12:00 noon

Staff Lounge: **Jim Strasma**
Computers in the church
Audience: those interested in computer use for 'business'

Auditorium: **Jim Butterfield**
More from the fount of knowledge
Audience: all

Room 426: **Steve Punter**
Using Bulletin Board Systems
Audience: those interested in data communications

Room 238: **Peter Hiscocks**
Designing command-driven programs
Audience:beginning to advanced BASIC programmers

1:30 p.m.

Staff Lounge: **Loren Wright**
BASIC programming for beginners (From Loren's column in MICRO)
Audience:BASIC programmers

Auditorium: **Dr. Frank Covitz**
Music with multiple SID chips
Audience: people interested in the '64 or computer music

Room 426: **Donna Green**
Introduction to word-processing
Audience: those interested in computer use for business

Room 238: **Dan Stockey**
Numerical analysis of Greek and Hebrew
Audience: those interested in computer use in religion

3:00 p.m.

Staff Lounge: **Greg Yob**
Gleanings from Greg's popular column in
Creative Computing
Audience: all

Auditorium: **Chris Bennett**
BASIC programming: using relative-record
files
Audience: beginning to advanced BASIC programmers

Room 426: **Donna Green**(tentative)
Advanced word-processing techniques
Audience: those interested in computer use for business

Room 238: **Brad Templeton**
Programming arcade games on the Commodore 64
Audience: those interested in the '64

Copy Session

We are targeting to have between 30 and 40 diskettes available for copying, with the emphasis on recent material. This means having all the VIC and Commodore 64 diskettes, the 'Best of' series, material from the past year by category, and hopefully the programs from the recent programming contest. Members must bring their own diskettes to the copy session, mark on them which diskette they want, drop off the diskette, and return to pick them up when the diskette has been copied.

Some of the library will be for sale on cassette at the conference.

Punter's Terminal Software

What it does

This software allows a CBM computer to be used as an intelligent terminal.

Equipment

One needs the following equipment to use this package.

- a 2000, 4000, 8000 or 9000 series CBM computer
- a 4040, 8050 or 8250 floppy disk drive
- an IEEE488 8010 modem, or Livermore Star

or

an RS232 modem (such as the GDC 103JD), with cable

- optionally, a printer

Programs

The current version of the Terminal Software is 12. The IEEE488 programs are called:

TERMINAL.I12 ... the BASIC portion
TERM.I12 ... the machine-language portion

The RS232 programs are called:

TERMINAL.R12 ... the BASIC portion
TERM.R12 ... the machine-language portion

Note that TERM.R12 also requires the program INTELCOM3.

How to start up

Make the TERMINAL.x12 program the FIRST program on your disk. Type SHIFT-RUN/STOP. You will now see the following menu on the screen.

Function:
1 - Terminal Mode
2 - Receive a program
3 - Transmit a program
4 - Open Disk File
5 - Print Disk File
6 - Change Operating Modes

Type a 1, 2, 3, 4, 5 or 6 and press RETURN.

Terminal functions

1 - Terminal Mode

The computer becomes a terminal. Press Menu. Press RVS then any key send a control character (eg. press RVS then C to send a CONTROL-C).

2 - Receive a program

See section on LOAD (downloading).

3 - Transmit a program

See section on SAVE (uploading).

4 - Open Disk File

Asks for name of disk file to be used to log this session (press RETURN to cancel). Return to Terminal Menu. Enter a 1 to use computer as a terminal. Then press CURSOR-DOWN to start logging the session to the disk file specified. Press CURSOR-UP to stop logging.

5 - Print Disk File

Enter name of disk file to be printed. Press RETURN to cancel.

6 - Change Operating Modes

This function has three options.

1) turn the Auto Line Feed option ON or OFF

2) set Parity to MARK (none), EVEN or ODD

3) return to Terminal Menu

Warning: High panic level cassette programs for VIC-20 Millipede (until Jan...31), Wallbanger or Roadtoad- $19.95 each + $1.50 postage and handling. Exclusive Canadian distributor: INFOSYSTEMS Limited., Box 2001, Sackville, N.B. E0A 3C0

PET 4032. Waterloo basic chip, more than 150 programs, dust cover, tape drive, instruction manuals plus Feb. 82 thru Feb. 83 issues of Compute Magazine. Excellent condition. Inquiries after 7:00pm 416-487-9587.

$70.00 Arrow ROM Chip for cassette system PETs. Features hyperspeed load, save, verify and append (6-7 times faster) plus several other features. Imported from Supersoft in Great Britain and distributed by William G. McConnell, 92 Kensington Place, Chatham, Ont. N7M 2X9. (1)

VIC-20 Income-tax programmes. Use them to calculate or verify your Federal and Ontario tax. Utility programme supplied to help changing for other years as well. Send $14.95 for tape to Micronuts, 108 Alexmuir Blvd., Agincourt, Ont. M1V 1H4

MICRO-64 A memory expansion tool for the Commodore 64. Page flips memory under basic and kernal ROMs to $C800-256 byte at a time, 16K obtained. With pause feature and quote mode escape. Retail $9.95. Dealer enquiries welcome too. East Fork Computer Software, 3511 Neals Circle, Batavia, Ohio 45103. Ohio res. add 5.5% sales tax. Specify storage media.

SUPER PET, two 9090 hard disk drives, one 8023P printer. All less than 6 months old. Steve Lawson 638-2309 evenings.

COMMODORE 4022P printer used 2 months. asking $825 519-524-9520, Darrel Carpenter 36 Anglesea St. Goderich, Ont. N7A 1T9

4040 DUAL DISK DRIVE (Upgraded 2040) like new, less than 2 yrs. old. Includes manual, cable, box of 10 diskettes, Commodore Assembler Package. Best Offer. Call 298-7312 evenings.

Attention VIC-20 and Commodore 64 users! Rubik Cube for C-64 and VIC-20 (16K necessary) for $14.00(tape). Do you want to traduct your software in "French" for the Quebec French speaking people, or for France? Have you some software to sell or to distribute? Other offers considered. Write: Logimicro Inc., 138 Deslauriers, Neufchatel, P.Q. Canada G2B 3P4 (2)

PET JOYSTICK INTERFACE Now any PET or CBM can use joysticks and game paddles. Accepts popular Atari- and Apple-style joysticks/game paddles. No assembly required. Ready to plug into User Port. Sample software provided. Only $69.95. Send check, money order, VISA/MC (please include exp. date) or specify C.O.D. to J Systems Corp., 1 Edmund Pl., Ann Arbor, MI 48103, U.S.A. Credit card orders, call (313) 662-4714 collect. (2)

PRO/RAM EXPANSION MODULE- Programmable, expandable, flexible. Powerful multi-purpose unit gives your computer an extra dimension. Compatible with Commodore PET/CBM Rockwell AIM and other Micro computers. Simple, complete,ready to use. Plugs in 24-pin sockets. Multiple use- favourite routines at your finger tips. Flexible- uses 2K and 4K devices(EPROMs, RAMs, E2PROMs) Selectable- easy switching of memory at conflicting addresses. Added capacity- retrieves 1,792 bytes of unused memory in PET/CBM. Expandable- PRO/RAM boards stackable for additional capacity. ONLY $34.95. Sygn, 677 Copper Dr., Vista, Calif. 92083 (619) 941-9249

FOR TRADE OR SALE

Single 2031 Disk drive plus cash for dual drive. Call Bonnar. 519-925-5376

CATALOGS

PET/CBM ADD-ONS FREE CATALOG. ECX COMPUTER COMPANY has over 20 new add on circuits and software for your PET/CBM computer and peripherals. For a FREE CATALOG send a self addressed stamped envelope to: ECX COMPUTER COMPANY 2678 North Main St. Walnut Creek, California, 94596 (3)

New Additions to the TPUG Library

PET

(P)TS
TPUG MARCH 83.G

AUTODISK BOOT.Z
WARLORDS INSTR.4
WARLORDS GAME.4
CUBE.4
LIST-ME.L
GRADEBK-NAMES.Z
GRADEBK-GRADES.Z
DP106-3.Z
SIMCAL INSTR.W
SIMCAL.Z
LOAN AMORT.8
LIST-ME2.W
HIBYTE DEMO.G
SCOPY5.8
SCOPY INSTR.8
80 COLUMN TAX.8
40 COLUMN TAX.4
COPY-ALL+.G
LIST-ME-LIST-ME
FUNCTION GRAPH.G

(P)TT
TPUG APR 83.P

FAST INVADERS.8
CRYPTOGRAMS.P
TURTLE.8
CBM 4032 V2.P
COPY-ALL.P
WP BUSTER/PET.P
LIST-ME APR83.W
DISK LOGGER.P
SUPERMON INST.P
SUPERMON1.REL.4
SUPERMON4.REL.P
SUPERMON2.REL.P
CBM8010.Z
LST TRUE ASCII.Z
PRINT USING.Z
IEEE WATCH 2.Z
MORTGAGE.Z
DISASSEMBLER.P
STRING THING.Z
PROG CONVERTER.Z
LIST-ME PTT.L
STORY WRITER/V10

C-64

(C)TS
TPUG MARCH 83.C

LIST-ME CG1
MONTANA.64
MONOPOLE.64
LABYRINTH.64
LIST-ME CU1
PIANO.64
DISKVIEW.64
SPRITE-BOOT.64
+SCROLL.64
+SPRITE ED.64
DOS.BOOT.64
+DOS 5.1.64
+DOS.INST.64
COPY-ALL.64
1541 BACKUP.64
SUPERMONV1.1.64
BOOT.CLYDE.64
+DEMO.GUTS1.64
+DEMO.C000.64
+DEMO13.64
SPRITE MANIP.64
TERMINAL.64
TERM.64

(C)TT
TPUG APRIL/83

LIST ME CTT.L
PONZO TUTOR-1.C
PONZO TUTOR-2.C
PONZO TUTOR-3.C
PONZO TUTOR-4.C
PROG CONVERT.C
PADDL TEST.C
PRNT PADDLES.C
TERMINAL DOC.C
LISTER.C
1525 CHAR.EDIT.C
KAT $ MOUSE.C
CLIFFY.C
MIN2.INS.C
MINOTON 2.C
TIME VEN INST.C
TIM VEN SETUP.C
TIME ADVENTURE.C

VIC

(V)TT
TPUG APR 83.V

2 JOYSTICK VIC.V
AIR GUNNERS.V
??????QQQQ
SCROLLING INST.V
SCROLLING.V
LABEL MAKER 8K.V
VIC DT
MAKE-A-SKETCH.V
HIDDENMAZE JOY.V
SNAKE.V
AUTO LINE#.V
MATH SKILLS.V
LOAN PROJECT.V
LOTTO.V
CAR COSTS.V
CALENDER.V
NIM.V

(V)TS
TPUG MARCH 83.V

VIC SLOTS
V TAX 82 ON V1.0
V TAX PART 2
V TAX PART 3
V 8K TAX 82
V RHINO
V 8K-LOAD
V 8K VICAB1
V 8K VICAB3
V 8K VICAB4
V 8K VICAB5
V BOMBER PILOT
V PAINT BY PEN
V CHINESE C'BOOK
V THUNDERBIRD
V ARITH CHALLENG
V NOTONE
V DRUM MANIA
V VICAB2
V BUSINESS DEMO
----LIST ME----

TPUG's This and That

At 9:35 on Thursday March 31 we processed member #6000. Welcome to Norman Coleman of Denver Colorado!

Delays

You've buried us in mail! Please be patient if your disks are a little slow in coming. We're adapting to the increased work load and the backlog will disappear very soon. Sorry for the delay in sending out your tapes. We had a bad run on our first attempt and had to remaster the tapes.

C-64 Owners

The Whole PET Catalogue was published in the Fall of 1982 and does not contain anything specifically for the C-64. This material focuses mainly on the PET as well as the VIC 20. Please bear this in mind when considering ordering it from this office.

U.S. Money

Since the cost of processing an order from a US member is higher than the cost of processing a Canadian order, we request that a US member pay for a membership, disk, tape or TORPET in US funds. Thanks for your cooperation.

PET Emulator

The PET Emulator from Commodore is not available yet in Canada and therefore we have had no experience in using it on PET programs. As time goes on we hope to be able to get this information from our members and pass it on. Please let us know of your experience with the emulator.

Doris Bradley
Assistant Business Manager

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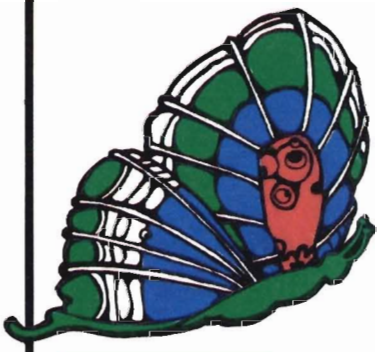

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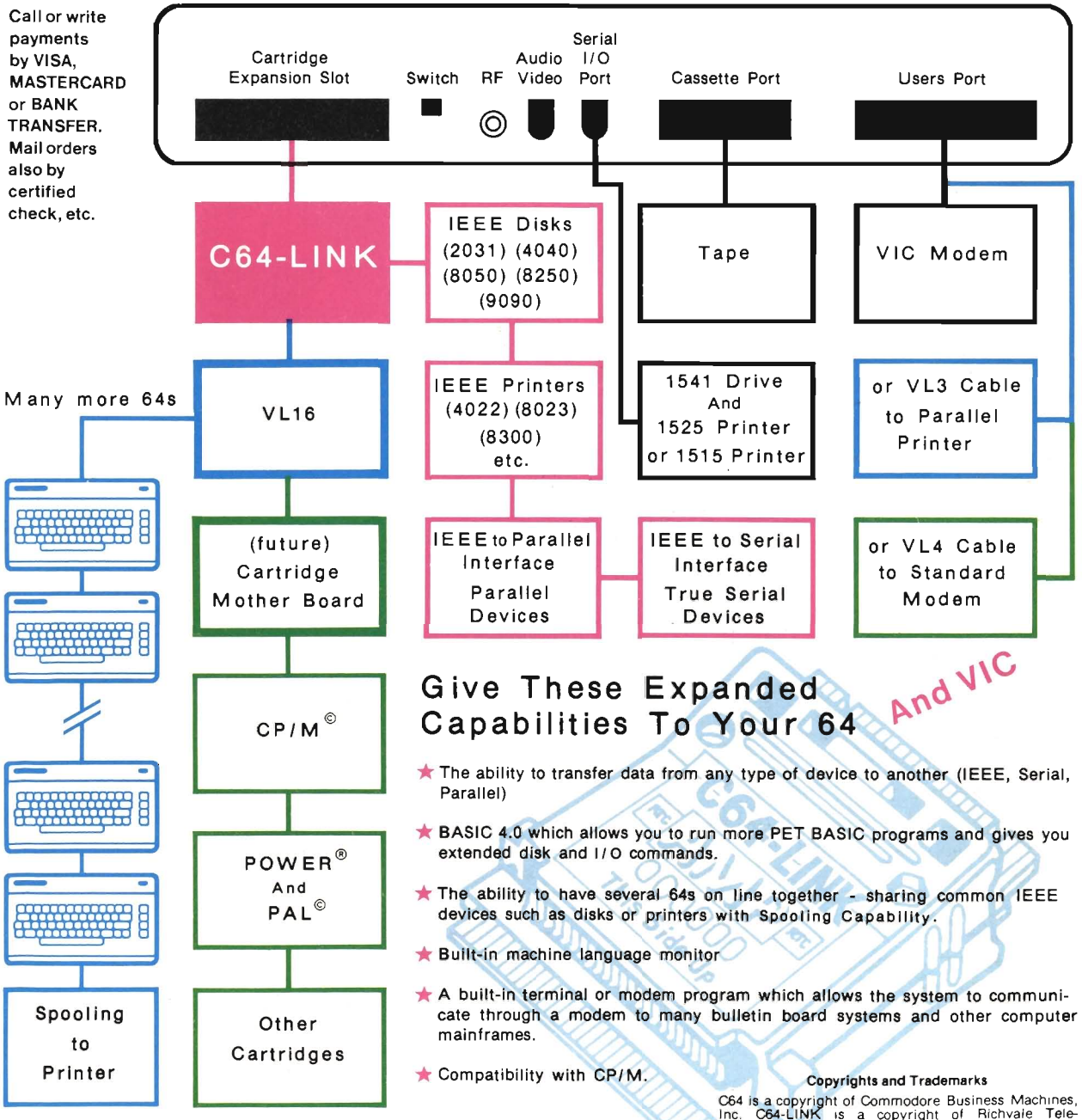

Give These Expanded Capabilities To Your 64 And VIC

- ★ The ability to transfer data from any type of device to another (IEEE, Serial, Parallel)
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- ★ The ability to have several 64s on line together - sharing common IEEE devices such as disks or printers with Spooling Capability.
- ★ Built-in machine language monitor
- ★ A built-in terminal or modem program which allows the system to communicate through a modem to many bulletin board systems and other computer mainframes.
- ★ Compatibility with CP/M.

Contact your local Commodore dealer or RTC.