commodore newsletter

Volume 1, Number 9

PET USERS CLUB

The Commodore Newsletter is an effective method of sharing current information, ideas, programming techniques, hardware interfacing, and cost effective applications relating to the Commodore PET/CBM computers, between PET/CBM owners, users and the manufacturer.

The Newsletter contains articles pertaining to product news, details on current software, time saving tips on programming (with listings), peripherals and attachments, and a User's Directory to other sources of PET/CBM information.

Members are encouraged to submit articles for publication in the newsletter.

The subscription fee is $15.00 for one year (or 12 issues). You may backdate your membership to the beginning of any year provided you specify this on your application. Backdated issues will be sent immediately and thereafter you will receive subsequent monthly issues.

TABLE OF CONTENTS

The Charter of the COMMODORE PET USER CLUB is to provide a method of sharing up-to-date information, and programs relating to the PET/CBM Computer between the many PET/CBM owners and users. Membership charges in the United States and its possessions are $15.00 annually (or 12 issues), while subscriptions outside the U.S. are $25.00 annually.

We would like to publish features from PET Users concerning specific applications, interesting discoveries or even bits worthy of sharing. If you would like to contribute to future NEWSLETTERS, please send your article, letter or comments to:

THE EDITOR
COMMODORE U.S. PET USERS CLUB
COMMODORE BUSINESS MACHINES, INC.
3330 SCOTT BLVD.
SANTA CLARA, CA 95051

EDITOR NOTES

We are happy to let our readers know that the EDUCATION EXCHANGE section has a new editor - Karl Zinn.

Karl Zinn has been a leader in the field of computers and education for 15 years. He participated in the organization of many professional and user groups, e.g., ACM SIGCUE, ADCIS and Educom, and numerous conferences including the World Conference on Computers and Education. He is active in the professional societies for computer science, engineering and psychology which contribute research and development for computer applications in education.

At the University of Michigan's Center for Research on Learning and Teaching, Dr. Zinn advises faculty on instructional use of computers. His own workshops for faculty at the University led to weekend "exploratoriums" for families wishing to look into personal computers for home education. In addition, he has contributed to the development of a "drop-in" center at the Community High School in Ann Arbor, a "family arcade" at an experimental elementary school, conducted demonstrations for scouts and other organizations, and offered short courses in the community.

His teaching within computer science and education at the University of Michigan includes introductions to computer programming and applications, development of applications in higher education, impact of computers on society, and computer uses in science education. Recent research projects include an assessment of the impact of microelectronics and telecommunications on college teaching, a study of the contributions of computer-aided communications to learning and scholarly work, and an analysis of community education activity combining microcomputers and cable television.
Regional services and information exchange have always been important. Karl Zinn founded and was associate director for the MERIT Computer Network in the state of Michigan, planned the task force on instructional computing in CIC (Big Ten universities and the University of Chicago), and directed Project Extend (now incorporated in the Michigan Association for Computer Uses in Learning). He initiated newsletters and other periodical communications for each of these regional service activities.

As a consultant to other organizations, Dr. Zinn has worked on the development and review of products for school systems, colleges, universities, equipment manufactures and publishers.

This combination of experience, expertise and contacts places Karl Zinn in an excellent position to contribute to our Education Exchange.

Education in the classroom is being revolutionized by the introduction of the microcomputer. EDUCATION EXCHANGE discusses how the Edina Public School in Edina, Minnesota has been able to utilize the PET computer in its education curriculum.

In January of this year Commodore participated in the annual Consumer Electronics Show which was held in Las Vegas. The show was very successful and was attended by over 50,000 visitors.

In March, Commodore will attend the Office Automation Conference in Atlanta. A short preview of this conference is presented in CBM NEWS. This section also presents a followup article on computerTOWN USA, along with a current computer and peripheral price list.

The SOFTWARE section reviews educational and business software packages which are designed to enhance the educational learning process and designed for small businesses respectively. A publication review is also presented to introduce our readers to current literature which is on the market.

Have you ever wondered if it is possible to control a movie camera with the PET/CBM computer? Be sure to

read the APPLICATION section to see how this can be accomplished.

Programming enthusiasts will be interested in reading the articles presented in the PROGRAMMING section. This section also contains Part II of Glossary Terms (acronyms and definitions from the MICROPROCESSOR LEXICON, courtesy of SYBEX, INC.)

For those interested in the PET/CBM Printers and the IEEE-488 systems, the PERIPHERALS AND ATTACHMENT section should not be overlooked. If you are interested in upgrading your printer, the PET/CBM Printer article will tell you how this can be accomplished.

The USER DIRECTORY/ANNOUNCEMENTS section contains a current authorized dealer list along with a correction to the CBM Floppy Disk User Manual.

Your response to this newsletter is valued. A complementary subscription (or if prefered, an additional twelve issues will be added to your current subscription) will be given to anyone who submits an article which is printed in a future newsletter. In order for us to effectively answer any questions you may have regarding your PET/CBM or newsletter contents, write:

The Editor
COMMODORE BUSINESS MACHINES
3330 Scott Blvd.
Santa Clara, California 95051

DATA EXCHANGE

The Save @ Command

Mr. Rex H. Shudde of Carmel, CA presents us with our first question:

Q IS THERE SOME SORT OF BUG IN THE SAVE"@ COMMAND?
A Yes. Do not use SAVE with replace or OPEN with replace (i.e., SAVE"@1:filename",8). This command does have a bug which can cause other files to be corrupted on the disk. Give your corrected file a new name instead, then scratch the old one. Further Errata information can be found in the User Announcement section.

The following questions are from Mr. Michael Baltay of Sun Valley, CA:

DOS Support 4.0

Q I RECEIVED THE DOS SUPPORT PROGRAM FROM YOU, AFTER SENDING A BLANK DISKETTE AND A STAMPED, SELF-ADDRESSED ENVELOPE. I RECEIVED MY COPY AFTER THE CHANGES PUBLISHED IN NEWSLETTER #7, AND IT DOES NOT INCLUDE THOSE CHANGES. WHICH IS THE CORRECT VERSION?
A The version printed in Newsletter #6 together with the corrections printed in Newsletter #7 is a previous version of DOS 4.0. However, this <u>is</u> still a working version. The version which you received is the most up to date version.

Note: If you currently have DOS 4.0 on disk, there is no need to make any corrections. If you do not have version 4.0 and would like to receive it, send us a blank diskette in its cover with protective cardboard backing along with a self addressed stamped envelope.

Concatenating Program Files

Q CAN I CONCATENATE TWO PROGRAM FILES ON THE DISK?
A The way to concatenate files is by writing a little program to get rid of the zeroes which precede the end-of-file marker and indicate the end of one program, and the starting address which indicates the beginning of the other.

```
READY.

 10 INPUT"1ST SOURCE FILE NAME";A$
 20 INPUT"2ND SOURCE FILE NAME";B$
 30 OPEN15,8,15
 40 PRINT#15,"I0"
 50 PRINT#15,"I1"
 60 OPEN5,8,5,A$+",P,R"
 65 GOSUB1000
 66 INPUT"DESTINATION DRIVE#";S$
 70 INPUT"DESTINATION FILE NAME";C$
 80 OPEN6,8,6,S$+":"+C$+",P,W"
 90 GOSUB1000
 100 GET#5,D$:IFST<>0THEN160
 105 IFD$=""THEND$=CHR$(0)
 110 IF F THENPRINT#6,E$;
 120 F=-1:E$=D$:GOTO100
 160 CLOSE5
 180 OPEN5,8,5,B$+",P,R"
 190 GOSUB1000
 200 GET#5,A$:GET#5,A$
 210 GET#5,D$:T=ST
 215 IFD$=""THEND$=CHR$(0)
 220 PRINT#6,D$;
 230 IFT=0THEN210
 240 CLOSE5:CLOSE6:CLOSE15
 250 END
 1000 INPUT#15,ER,ER$,ET,ES
 1010 IFER<>0THEN1050
 1020 RETURN
 1050 PRINTER,ER$,ET,ES
 1060 STOP
READY.
```

The 32K PETS

The following questions are from Mr. Art Bosley of Jeannette, PA:

Q WHAT DOES THE CMD COMMAND MEAN?
A CMD is an abbreviation for COMMAND and is used to address an IEEE bus device and leave it addressed and listening. It is like PRINT#, except that it leaves the device listening.

Q HOW DO YOU PROGRAM SO THAT THE PROGRAM DOES NOT LIST CERTAIN LINE NUMBERS?

A Len Lindsay has written an article entitled, "Protect Your Program", which was published in THE BEST OF THE PET GAZETTE on page 60. This article has been reviewed in the PET GAZETTE (Spring 1979, page 12) by Jim Butterfield. For your convenience, we are sending you a copy of these articles. Len Lindsay can be contacted at:

1929 Northport Dr. No. 6
Madison, WI 63704

Language Difference Between the PET and the Printer

We have received many inquires which may be summarized as follows:

Q I HAVE A PET PRINTER AND AN 8K PET. WHEN I POKE59468,14 (UPPER/LOWER CASE MODE) AND TYPE A SENTENCE IT LOOKS ALRIGHT ON THE SCREEN, BUT WHEN I PRINT ON THE PRINTER ALL I GET ARE THE LETTERS TYPED IN UPPER CASE AND GRAPHICS. I THEN PUT THE CURSOR DOWN AS PER THE MANUAL, AND EVERYTHING IS REVERSED: UPPER IS LOWER AND LOWER IS UPPER. ALSO, WHEN I PRINTED ON THE SCREEN, THE LINE MOVES DOWN A LINE. IS THERE SOMETHING I AM DOING WRONG?

A No, the printer simply understands a different language from that of your PET's. For a thorough explanation, please refer to the article on CBM Printers in the Peripherals & Attachments section of this newsletter.

The Append Wedge Program

Q THERE IS AN AMBIGUITY IN NEWSLETTER #4-5, PAGE 30; LINE #0158 IS REPEATED TWICE, AND ADDRESS LOCATION 03FA IS FOLLOWED BY 03FF. SHOULD ANY PARTICULAR CODE BE TYPED INTO LOCATIONS 03FB, 03FC, AND 03FE? IF SO, WHAT IS IT? (00 IN ALL OF THEM CAUSES A CRASH.)

A This ambiguity is caused by a typographical error. The following chart will help solve the problem. These are the bytes that go in that area.

Bytes in 03F8-03FF

03F8	$0D	
03F9	$41	A
03FA	$50	P
03FB	$50	P
03FC	$45	E
03FD	$5E	N
03FE	$44	D
03FF	$00	

CBM NEWS

NCC-OAC Preview

March 3-5, CBM will participate in the first annual National Computer Conference - Office Automation Conference in Atlanta. This conference is the "world's first major, all-inclusive conference for office systems users, designers and managers to assist them in meeting the realities of office automation in a responsible, competent and fruitful fashion".

As microcomputer technology expands into the business office, the industry has clamored for a conference vehical. NCC has responded by presenting the Office Automation Conference.

At the conference, Commodore will demonstrate business, educational and professional software applications. Demonstrations will be conducted by CBM marketing personnel and personnel from major software firms. CBM will also be introducing new products during the conference.

In the next issue of the newsletter, we will be previewing these new product introductions and will also review the show.

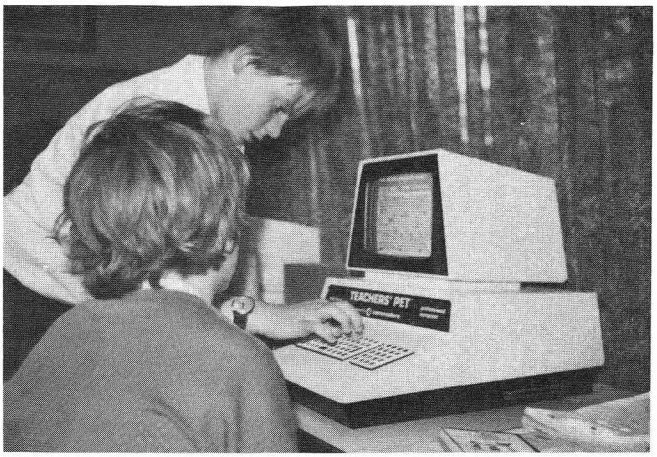
Computer Town USA

By Barbara Beighley

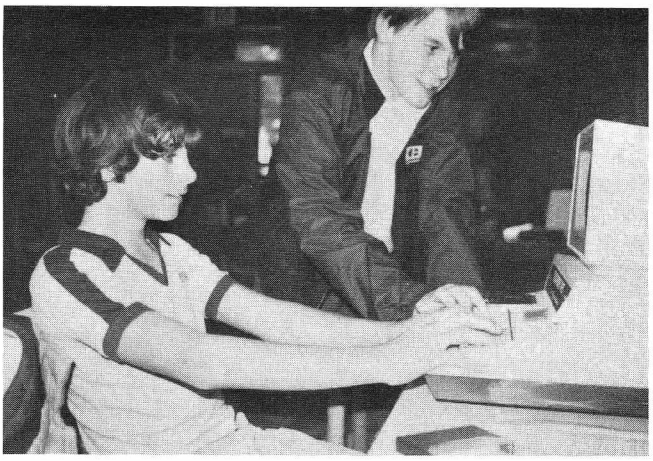
In the previous issue of the Pet Users Club Newsletter, the background information of a unique project was outlined. ComputerTOWN USA is an example of an ingenious concept becoming a working reality. The program's objective, aside from promoting computer education for the young, is to introduce the value of creating a computer-literate community. This is being accomplished as we witness a generation of youngsters teaching their peers and the adult generation which preceded them.

Originally, Bob Albrecht, known as the "Dragon of Menlo Park" instructed a one hour "check out" period during which children learned to load and operate the computer, and received their certification upon successful completion.

Two young men, Jim McLenahan, twelve years old, and fourteen-year-old Scott Lavier have advanced to the level of "teaching assistants" at the library. On Monday afternoons and all day Saturday, Jim and Scott instruct newcomers as to the check-out procedure using the Pet Computer.



Jim and Scott provide a helping hand



So overwhelming is the success of the project, that Albrecht predicts "a student consultant assisting the children every afternoon and all day Saturday and Sunday as well. The idea of "kids teaching kids" is unique, but the key to the project is the cassette operating system on the Pet. It is so easy to use and so reliable, according the "the Dragon", rarely is there a loading error.

Presently the library has fifty programs available, but Albrecht hopes to double this number within the next few months. He categorizes three areas of programs available: educational; recreational games; and thirdly, games which have incredibly rich educational value. All the student must do to attain a tape is present their library card and their certification badge at the childrens' desk, and they have privileged "Pet usage" for one hour. Usually more than one child uses a computer allowing the benefit of gaining mutual programming experience, and still experiencing individual progression as well.

Albrecht summarizes the program by stating, "The best way to learn programming is to have fun while you're doing it. And in a town of 27,000 people, we may see a few thousand programmers in the near future".

COMPUTERS & PERIPHERALS

MODEL	DESCRIPTION	SUGGESTED RETAIL
COMPUTERS		
PET 2001-8K PERSONAL COMPUTER	Standard PET with integral cassette, 40 column by 25 line display, calculator type keyboard, and 8K bytes of memory. (BASIC 2.0 OS)	$ 795.00 (90-day special order only)
PET 2001 PROFESSIONAL COMPUTER	PET with large terminal styled keyboard with separate numeric pad & graphic keys and a 40 column by 25 line display. (BASIC 3.0 OS)	8N 795.00 16N* 995.00 32N* 1,295.00
CBM 2001 BUSINESS COMPUTER	Features a typewriter styled keyboard with separate numeric pad and a 40 column by 25 line display. (BASIC 3.0 OS)	16B 995.00 32B 1,295.00
CBM 8000 BUSINESS COMPUTER	Features a typewriter styled keyboard with separate numeric pad, an 80 column by 25 line display and new screen editor functions, and BASIC 4.0 Operating System.	8016 1,495.00 8032 1,795.00 (Available June 1980)
PERIPHERALS		
CBM 2022 PRINTER	80 column dot matrix printer with plain paper or forms handling tractor feed. Has full PET graphics, variable line spacing, programmable character and character enhancement.	795.00
CBM 2023 PRINTER	80 column dot matrix printer. Plain paper printer with full PET graphics, programmable character and character enhancement.	695.00
CBM 2040 DUAL DRIVE FLOPPY DISK	Dual drive intelligent 5-1/4" mini-floppy disk system with 341K net user storage capacity. (DOS 1.0)	1,295.00
CBM 8050 DUAL DRIVE FLOPPY DISK	Dual drive intelligent 5-1/4" mini-floppy disk system with over 950K byte net user storage capacity. (DOS 2.0)	1,695.00 (Available June 1980)
CBM C2N CASSETTE DRIVE	Cassette input/output unit to use with PET/CBM computers.	95.00
CBM MODEM	High performance 300 BAUD IEEE interfaced modem features accurate teleprocessing communication for your CBM system.	395.00 (Available June 1980)
CBM VOICE SYNTHESIZER	Features phoneme synthesis for vocabulary construction (rather than memory limited digital techniques). User port interface permits easy installation to any CBM/PET system.	395.00 (Available June 1980)
CABLES		
PET to IEEE CABLE	Use this cable to connect your Floppy or Printer to any PET/CBM Computer (P/N 320101).	39.95
IEEE to IEEE CABLE	Use this cable when connecting more than one peripheral (Floppy and Printer) to any PET/CBM Computer (P/N 905080).	49.95

*Commodore BASIC 4.0 Operating System available by June for an additional $100.00.

Prices subject to change without notice

EDUCATION EXCHANGE

Editor: Karl Zinn

Happily, the Commodore support group has decided to give significant space to education within each issue of the Users Newsletter. At least it should be a happy thing for educators reading the Newsletter. But then, nearly everyone working with micros is also working with education. Some of us teach in schools or colleges, but all of us are involved in educating others about, with, or through computers. Some of us develop or market products to schools and colleges, but nearly everyone is concerned about (and perhaps contributing to) eductional products for use in the home. No one who cares about reasonable use of micros can avoid getting involved in how to offer explanations and assistance to others. So this section on education can be helpful to everyone!

When I heard of the plan to provide an Educational Exchange I offered to help collect material that will from the start establish the value of the education section of the Newsletter. I know there to be lots of good material: information, ideas, commentary, and questions. Reports from users in a variety of situations, however casual and fragmented, provide much value to other users, much more than the contributors typically realize. Consider some of the information you have, or questions or problems.

At the outset, a dozen projects could provide lists of programs they distribute, apart from the regular commercial fare. Abstracts from CONDUIT in Iowa City and MICROPHYS in Brooklyn appeared in issue #8. Education as a market for software does not get enough attention. And yet some users need only good examples, even just the skeleton of a program, to get then started on improved local development activities. We should soon hear from CUE in the Bay Area. General information can be helpful too. The brief note on computerTown USA in issue #8 is sure to be encouraging to others wishing to encourage personal computing throughout a community.

I know a dozen other sources of good advice which should share informal reviews on some of the commercial offerings. Would you like to comment on Milliken math, PDI vocabulary development, CONDUIT science? And what about advice on maintaining the old 8K PETs, or making the most of the new ones? Can education afford to use disk drives, or afford not to? In addition to hints about equipment and software in educational settings, what about suggestions for new products?

Send me what you have to share, whether in prose, lists or annotations. If you have some ideas but don't have time to write then down (or aren't sure they are novel) give me a call. When I am not at my desk my number is answered by a tape recorder. Since the recorder operates until it runs out of tape (45") you could dictate an entire article!

Material will be selected and edited to make good use of the space allocated to education in the Newsletter. I hope to make room for all the good ideas. Incidentally, material which appears in the Newsletter can also be published elsewhere. Typically one would get early information out to some users in the newsletter, and later publish in detail and with polish in an education magazine or journal.

I will submit some information about how more than sixty PETs are being used in education at the University of Michigan, and a list of needs, problems, and ideas resulting from the experience of college teachers. Since some of the PETs are used in a teacher education program, pre-college applications are included as well. When I started the ACM Bulletin on Computer Uses in Education more than a dozen years ago I had great expectations for exchange of information via newsletters. Experience as contributing editor or advisor for 15 newsletters, bulletins,

magazines, and journals since then has not diminished my enthusiasm for exchange among readers.

Eventually we will be using something like a community bulletin board system (or at least some well organized electronic mail on The Source or Micronet) for swapping information about micros in education. Wouldn't it be nice to be able to determine what software is under development by what organization or project before investing much time and effort in a new micro-based curriculum? If you would like to work on developing such an electronic exchange for the PET in education (or micros generally), let me know. Some of us are trying out one or another computer-based conference or CBBS now, but the costs are too high to reach many of the people who should be involved.

In any case, send or call some information to me for the new Education Exchange of the Newsletter!

Karl L. Zinn
U-M CRLT
109 E. Madison St.
Ann Arbor, MI 48104
(313) 763-4410

Microcomputers in the Classroom

By Thorwald Esbensen
COORDINATOR OF ELEMENTARY CURRICULUM AND INSTRUCTION
Edina Public Schools
Edina, Minnesota 55435

In January, 1975, the computer marketplace witnessed the advent of a product that seems likely to have great impact on the way we do business in the classrooms of America. A brief account of its features and educational significance is the burden of what follows:

Everyone has heard about computers. Depending on one's point of view, they are those electronic marvels that are either the bane or boon of humankind. Their amazing ability to analyze, assess, and predict has made them an indispensible tool of modern enterprise. Indeed, the word "tool" seems too modest a designation for machinery capable of such wizardry. In any case, we are all familiar with the popular mythology surrounding computers, and each of us harbors an individual opinion accordingly.

Gertrude Stein once observed that a rose is a rose is a rose. In similar fashion, most people are probably prone to believe that a computer is a computer is a computer. But this notion is wildly mistaken and nothing illustrates this fact better than the microcomputer.

In the first place, the microcomputer is small. Heretofore, those numerous magazine pictures showing elementary and secondary school youngsters working away at computers were not showing computers at all. They were displaying computer terminals. There is a big difference.

A computer terminal is not a computer. It is simply a device generally connected by telephone to a computer for the purpose of sending and receiving information. And there's the rub. Without Ma Bell's umbilical cord to transmit intellectual nourishment, the terminal is as dumb as an empty box. This means that it is both relatively cumbersome and expensive to use. As the Minnesota Educational Computer Consortium (MECC) has so amply demonstrated for years, unless a classroom has a telephone, the terminal cannot be used in a classroom. The upshot of this state of affairs is generally an arrangement that finds the terminal placed in a little room down the hall someplace -- a location usually distinguished by its inconvenience to all concerned. Given this solution to the problem of making computer assisted instruction available, is it any wonder that not much has really happened in this arena of student learning?

The microcomputer enables school people to create a different scenario. Not only is it small. It is a free-standing computer in its own right. And it is a powerful one at that. As a matter of fact, it is so potent that for all practical purposes its possibilities are limited only by the imagination of those who program it and make decisions regarding its placement and use. When, in addition to this bold assertion, we can also affirm that its cost is often no more than that of a good television set, it is plain that we are on the verge of grappling with technological opportunities that may in time be truly awesome.

Let us now consider a specific case. It is small in scope, but it illustrates a point of view which may be worth pondering by other school systems that have not yet formulated an approach to the matter.

The Edina Public Schools have currently purchased a total of forty-eight PET microcomputers. The bulk of these are located in our elementary schools.

The first classroom teacher in Edina to use microcomputers as a regular part of the daily instructional program was Lois Baker, a first grade teacher at Wooddale Elementary School. Lois received her first microcomputer a year ago last spring. A second one was added to her classroom in the fall of 1978.

(Note two things in this connection. First, in order to counteract the erroneous impression, widely held, that computers are best utilized by math buffs, our first microcomputer was placed in a self-contained elementary classroom. Second, in order to make it clear that computers can be successfully used even by very young children, a first grade classroom was chosen for the placement.)

I recently had the following conversation with Lois concerning her classroom experiences with microcomputers:

E (Esbensen): How do your first grade youngsters like using microcomputers?

B (Baker): They like it. And every child gets a chance to use it - often.

E: Do you use microcomputers on a daily basis?

B: I certainly do. As you know, I have more than enough microcomputer programs to keep both of the machines busy. My main task is to work out a schedule of suitable times when my students can best work with the computers.

E: Is that a problem?

B: That's always a problem. Right now, my students are regularly scheduled on the computers five days a week, from 2:45 p.m. to 3:15 p.m. The computers are also being used by a variety of students during recess and through the noon hour. But I am sure I can do better than that eventually. For example, during the reading period, some students could be assigned to work with the computer on the WRITE TO READ program that has been developed for it. It's a management problem, really. But that's true for any kind of teaching where you have activity centers or learning stations.

E: Your computers are located right in your classroom. Is that an advantage?

B: Definitely. I would feel very uncomfortable if I did not have this arrangement. I want to decide myself how to organize my instructional day. If these computers were located somewhere else in the

building, the whole situation would be changed for me. I wouldn't have the flexibility that I do now. I would have to say that in that case the computers would lose alot of their present usefulness - at least for me. Does that make sense to you?

E: It makes a whole lot of sense. Tell me, Lois, do you have your students work alone on the computer?

B: Do you mean as individuals one at a time?

E: Yes.

B: I do at certain times. But I also use student tutors to a great extent. I find that there are real benefits to be gained by having students work together in pairs. For example, in the WRITE TO READ program, the student tutor will be someone who has previously mastered the lesson, and ---

E: Does that mean using older students as tutors?

B: Sometimes, yes. But I am discovering that first grade children can also serve as tutors to other first grade children. The important thing is to make sure that the tutor is someone who is well-organized and calm, someone who can follow through on the step-by-step procedures that I have outlined for tutors. Tutors monitor the work of their partners. They record results. Also, having students work in pairs helps each one attend better to the work at hand.

E: If you were to summarize the results of your experiences with microcomputers, what would you say?

B: I would say that microcomputers have added another dimension to my teaching. I'm excited about what they have to offer, and I look forward to using them even more effectively as time goes on.

On November 27, 1978, The Minneapolis Star ran a front page story on educational computers. In that story, Minnesota Education Commissioner Howard Casmey was quoted as saying, "Computer education will be the salvation of free public education."

Commissioner Casmey went on to qualify his startling prediction by adding that he didn't think computer education is a "panacea in itself". Nevertheless, with declining student enrollment and its attendant decline in course offerings, it was clear to the Commissioner that "we'll have to find alternative ways" to provide appropriate instructional opportunities for students.

In January 1975, a computer revolution was initiated with the introduction of the Altair 8800 microcomputer. In a report prepared for the National Institute of Education by Ludwig Braun, Professor of Engineering and Assistant Director of Educational Technology of the National Coordinating Center for Curriculum Development, State University of New York at Stony Brook, this summarizing view of where we are today was set forth:

"We see through a glass, darkly," the Scripture writer said. It is difficult also to predict the character of the classroom a decade hence, or the role of the computer in it. It is difficult even to predict what this computer will be able to do, or how much it will cost, in view of the dizzying pace of developments since January, 1975.

"The microcomputer era upon which we are embarking already has been characterized as the era of the personal computer. It certainly will be that, but it promises to be much more. Educational and social historians someday may look upon January, 1975 as the start of the time when the computer enabled humans to expand their intellectual powers beyond our present comprehension."

SOFTWARE

Educational Software

National Coordinating Center for Curriculum Development

The National Coordinating Center for Curriculum Development is making available a number of educational computer programs for use on the Commodore PET. Programs are available in the disciplines of mathematics, science, language arts and social studies. Most of the programs are designed for use at the secondary school level, while some of them are appropriate at the elementary school level.

The programs are written in the BASIC language and will run on 8K PETS. Each program is available on cassette tape for a nominal fee.

*Program titles followed by an "!" contain sound.

Mathematics

TICTACPET!

Improve your Algebra I students' skill in solving linear equations by providing them with drill and practice in a game format. Nine randomly generated linear equations are placed in a 3 x 3 tictactoe grid. Two students, or two teams of students, compete to capture three squares in a row by solving the equations within them. A new set of equations is presented each time the game is played. With nine levels of difficulty, TICTACPET can be used throughout Algebra I.

HICALC

A challenging program for Algebra II students which allows them to rearrange the coefficients of algebraic expressions in x and discover the effect of these manipulations on their value. The computer randomly generates five coefficients and the value of x to be used in various algebraic expressions. The students experiment with different arrangements of the coefficients in an attempt to maximize the value of the expression. Along with practice in integer arithmetic and evaluation of expressions, students are allowed to discover relational patterns between integers and arithmetic operations.

POINTS

A discovery learning approach to plotting points in the Cartesian plane, this program is suitable for any student first learning the technique or needing remediation. Through simple animation, students are able to explore the coordinate plane. They are led to discover the relation between a point's coordinates and its location in the xy-plane. Students are given the opportunity to name the coordinates of given points and then to plot points given their coordinates. These points are connected by the computer to form pictures.

TICTACARITH!

A fun way to provide young students with drill and practice in the basic operations. Any combination of the four basic operations can be chosen, with numbers appearing in any specified range. Nine arithmetic problems are randomly generated by the computer to your specifications and placed in a 3 x 3 tictactoe grid. Students compete to win three squares in a row by solving the arithmetic exercises in the squares. Appropriate where extra drill work is desired.

PROBABILITY MACHINE

An animated version of Galton's probability demonstrator. Balls fall from the top of the

triangular demonstrator and wind their way downward, being deflected left and right at random as they hit the small obstacles in their path. The balls then fall into, and gradually fill up, tubes along the bottom of the screen. When the experiment is performed with a large number of balls, the pattern formed when the tubes fill approaches a normal distribution curve. The experiment can be performed as often as the students wish and can provide data for simple statistical analyses.

HURKLE!

Let your students find the missing HURKLE. Designed for elementary school students, this program provides practice using a coordinate system, develops logical thought and reinforces the concepts of left, right, up and down. A HURKLE, an imaginary creature, is hidden somewhere on a 10 x 10 grid. Students guess its location and enter their guess by typing a pair of coordinates. The named grid point is lit, and both visual and auditory clues are given indicating the direction in which the HURKLE lies. When the HURKLE is found, students are rewarded with the flashing picture and sound of a HURKLE.

Science

POP

Study the population dynamics of simple organisms. Discover the effects of reproductive rates, high and low population densities, and initial population size on population growth. Choose from three population growth models: exponential, logistic, and logistic modified for low density. Specify the parameters, and the computer will graph population over time. Change any or all of the parameters, and a second graph will be superimposed on the first, allowing you to see the effect of your changes. As many as four graphs can appear on the screen at a time to permit the student to explore the effects of parameter variations.

POLUT

How do changes in temperature affect the pollution levels of ponds, lakes, rivers? How are pollution levels affected by the use of treatment plants? At what rate can pollutants be dumped into a body of water without killing the fish? POLUT will allow you to investigate these problems without causing damage to the environment. Enter the parameters, and the computer will graph the level of pollutant as well as the oxygen content of the water. A dead fish appears on the screen if the oxygen level drops too low. Three sets of graphs can be displayed at a time to permit the student to explore the effects of parameter variations.

Order forms are available from:

National Coordinating Center for Curriculum Development
College of Engineering and Applied Sciences
State University of New York at Stony Brook
Stony Brook, NY 11794

In our next issue will review the remainder of this software package - Language Arts, Simulations, and Social Studies.

Evans Newton Incorporated

EVANS NEWTON INCORPORATED (ENI) is headquartered in Scottsdale, Arizona. ENI specializes in programming computers, publishing Objective-Based

instructional materials, and inservice programs which assist school districts in the administration and management of Competency-Based Instructional Programs.

The ENI Publishing Division Staff writes Objective-Based lesson plans for reading, language arts, and mathematics, grades K through 8, which are used in conjunction with ENI's Microcomputer-Assisted Instructional Programs.

The range of ENI Microcomputer Programs is limited only by the fact that ENI specializes in education. If they do not have a particular program which meets your needs in the existing library of programs, the ENI Programming Staff can quickly and efficiently write such a program. The range of programs is:

A. Business Administration
   1. Budgetary
   2. Financial
   3. Personnel Record-Keeping
   4. Payroll
   5. Absenteeism
   6. Inventory
   7. Other

B. Educational Administration
   1. Computer-Managed Instruction (CMI)
   2. Attendance
   3. Scheduling
   4. Grade Reporting
   5. Guidance
   6. Diagnostic and Prescriptive Testing
   7. Other

C. Classroom Instruction
   1. Computer Assisted Instruction (CAI)
   2. Teaching Basic Computer Skills
   3. Gaming and Simulation
   4. Other

For information regarding these programs contact:

EVANS NEWTON INCORPORATED
Thunderbird Plaza
7500 East Butherus Drive Suite P
Scottsdale, AZ 85260

In our next issue, we will present a comprehensive review of Computer-Managed Instruction (CMI) which is program B1 in ENI's educational package.

Business Software

CompuMax, Inc.

Five application packages are available for the small business. These systems were conceived and designed with simplicity in mind. All functions are reduced to the absolute essentials, yet the packages offer powerful features to perform their task.

Foolproof, step-by-step procedures are supplied, planned and documented for the first-time computer user. All programs are self-explanatory, telling the user what is required at every step.

Each package has its own data entry program and facilities to list, verify and update data. The programs are written in "BASIC" and the source code listing is supplied.

Each system uses two files of its own: a master file and a transaction file. Each system may be used in a stand-alone mode; through the JOURNAL file of the General Ledger system, however, the transactions of all systems will ripple through the accounting routines and financial reports.

File Backup and Recovery

The PET version of the packages includes a special FILECOPY program. This program will enable the user to create a backup file for each working file.

Then, if anything happens to the data due to the depression of a wrong key, or a power failure, the user can recover the good file with a single command.

This feature enables the user to limit the loss of data by choosing the appropriate frequency of backup operations.
The Demo Data diskettes supplied already have on them sample data files. This enables the user to become familiar with the backup and recover features rapidly.

GENERAL LEDGER SYSTEM

MICROLEDGER performs the essential duties of dual entry bookkeeping and the matching of revenues and expenses.

The first program builds and maintains your CHART OF ACCOUNTS master file. This file also holds your current and accumulated totals in each account. You may have up to 793 accounts.

The second program sets up and updates your JOURNAL transaction file. Next, you will do your TRIAL BALANCE. You have several resources to make adjustments to your figures.

Once you approve of the figures, you go ahead and do your POSTING. The program now outputs an AUDIT TRAIL of all your transactions. These are sorted by account number, to make it very easy to trace the story behind the figures.

The audit trail output also becomes a fine front page for your 3-ring binders, in which you keep your actual records.

Another backup produced by the system is the diskette itself. Here you have two alternatives. You may just retain each data diskette as a permanent record for that accounting period. This practice allows you later reruns, modeling, etc. Or else, you may rename and resave your data files on the same disk. Say your September '78 journal becomes SEPT78. In this fashion, you may keep many old files on the same disk.

Finally, you get your financial reports. The fifth program produces your PROFIT AND LOSS STATEMENT. An easily read standard format shows all your accounts by category, your total revenues, total direct expenses, total G. & A. expenses and your income (or loss) for the period.

The last program prints (or displays on the screen) your BALANCE SHEET. Assets, liabilities and owners equities are shown by account and by totals.

Since there are only two files, the system may be set up rapidly. Both current and prior period adjustments are made quickly, either by journal update and re-run or directly via chart update in a single operation. Thus, the system is eminently suitable for "What-if" kinds of modeling usage.

ACCOUNTS PAYABLE SYSTEM

MICROPAY consists of a series of computer programs that carry out the Accounts Payable functions for a small business. MICROPAY is designed to provide an essentially simplified sequence of operations that can be easily executed on a microcomputer by a person who has only the basic familiarity with such a system.

The first program lets you initialize your A/P transaction file and master file. Then you may start entering A/P transactions.

Data include vendor name, invoice number, description, quantity invoiced, receiving date, voucher number, quantity received, purchase order number, quantity ordered, ledger account number to be debited, ledger account number to be credited, street address and city-state-zip of vendor.

Later programs provide the means to accumulate transactions into your master file, which becomes your A/P history file. You may select to pay accounts for a single date, or for a range of dates. The program will count the appropriate records and tell you the number of continuous check forms required. It will then print your checks, ready to be mailed to the vendors.

The programs will also keep the master file updated and transmit the A/P information to the JOURNAL file. From

there, MICROLEDGER will pick them up and integrate them with your other transactions.

Service routines make it easy to list both the transactions file and the master file, in case you find an error, or some data have changed since you entered it, update routines carry out the changes quickly.

Reporting routines include facilities to output the following reports:

- Cash requirements (single date/range of dates)
- A/P single vendor/all vendors
- A/P single date/range of dates

The user manual explains options in detail; contains sample data and sample runs; shows the exact format of check form and stub form to be printed with the company name and bank numbers to be able to use the printing program.

ACCOUNTS RECEIVABLE SYSTEM

MICROREC is the Accounts Receivable counterpart package, quite similar to the A/P system.

The data employed by MICROREC include:

- Customer name and address
- Purchase order number
- Invoice number
- Invoice date
- Amount
- Description
- Quantity invoiced
- Waybill number
- Ledger account number to debit
- Ledger account number to credit

"Conversational" programs help you enter the data rapidly and easily. A transaction file holds your A/R until a period is ended and you want to accumulate them into the master file.

The master file is a permanent record of all A/R enteries and customer payment receipts. Both the transactions file and the master file may be easily inspected and updated at any time.

There are several reporting routines. You may ask for the following outputs:

- Print Invoices
- Aged Trial Balances (under 30 days, 31-60 days, 61-90 days, over 91 days)
- Receivables by Customer. You have the option to request reports for a single customer or for all customers.
- Receivables by Date. In this program, you can ask for a statement covering a single date or a range of dates. The statements will also produce the corresponding cash projections.

Finally, the journalizing option will create the journal file entries that correspond to each A/R as it is entered, as well as to the receipt of each customer payment as it is input.

These transactions will ripple through your trial balance, posting, profit and loss statement and balance sheet - if you are also a user of MICROLEDGER.

INVENTORY CONTROL SYSTEM

MICROINV is a series of computer programs that carry out the INVENTORY CONTROL functions for a small business.

There is an inventory transactions file and a master file. The data employed are the following:

- Item number and description
- Quantity on hand
- Quantity on order and delivery date
- Unit price and name of units used
- Lead time, Reorder point and Safety stock
- ABC class describing frequency of usage
- Vendor name
- Job allocation

Each transaction is identified by entering the quantity issued or received, current price and job or work order classification for an issue.

The program will accumulate the transactions: current average cost, LIFO (Last-In First-OUT) cost, year-to-date usage and job cost allocation will be updated.

At any time you may ask for:

- Stock Analysis Report, showing your standard inventory stock data and stock valuation.
- ABC Analysis, breaking down the inventory into groups separated by frequency of usage.
- Job Cost Report/Materials, showing totals allocated to each job or work code used. When this report is used jointly with Job Cost Report/Personnel in MICROPERS, you get complete job cost control.
- Economic (or Optimal) Order Quantities for all items for which you have cost of placing an order, expected annual demand and annual inventory carrying cost available.

Finally, all inventory receipt or issue transactions will be journalized and made available to MICROLEDGER for automatic entering into your trial balance, posting and financial reports.

PAYROLL/PERSONNEL

In the MICROPERS package, you get two systems for the price of one: a complete payroll system and a personnel management system.

The first program creates and updates your master file of PERSONNEL. Data include:

- Name and address, telephone, social security number
- Married or single status
- Action (like hire, raise, fire, etc.)
- Date of action
- Position
- Salaried or hourly category, rate
- Number of exemptions
- Miscellaneous deductions
- Job or work codes

The second program sets up and maintains the file for PAYROLL transactions: regular and special times worked, percentage on each job or work code.

Subsequent programs compute the PAYROLL REGISTER. Once all deductions and figures are checked and approved, PAYCHECKS are printed and payroll transactions are journalized.

The documentation includes the current Federal and California State witholding tables. By examining these tables along with the commented data statements that hold the rates and the cutoffs, it will be easy for the user to update the program for a future change in rates, or to customize it for another state.

Further programs produce:

- Annual W-2 Forms
- Values for quarterly 941 report
- Job Cost Report/Personnel
- History for any employee
- Complete history for all employees

The user should back up the PAYROLL file before carrying out the PAYROLL REGISTER computation. Then the same data may be recovered, should an update be necessary before printing the checks.

These programs cost $140.00 each or $700.00 for the entire package, and are available from:

CompuMax Associates, Inc.
467 Hamilton Avenue Suite 20
Palo Alto, CA 94301

PUBLICATION REVIEW

Magazines

Compute Grows On

By Robert Lock

We began, as most of you readers know, by acquiring The PET Gazette, a magazine started by Len Lindsay almost two years ago. Len Lindsay's PET Gazette is gone, and a section of COMPUTE now carries that title. Len continues to provide material to COMPUTE, as well as many other magazines. (Rumor even has it that Len is hard at work on two books for a west coast publishing house). In the Jan/Feb issue, you'll find his brand new column, The Consumer Computer, a column devoted to the joys of the personal 6502.

PET User Notes is now a part of COMPUTE. Originally started by Gene Beals, of AB Computers, the Notes were more recently the product of Roy O'Brien. When job responsibilities and a west coast transfer created more than the usual problems in keeping up the Notes, Roy and Gene and I got together on an orderly "cross-over" of the Notes into COMPUTE.

6502 User Notes is now a part of COMPUTE. This is the oldest of the magazines to join COMPUTE. Founded by Eric Rehnke almost three years ago, the 6502 User Notes bring a welcome readership to COMPUTE. With the help and contributions of this group, you'll see a very healthy Single Board Computer section of COMPUTE.

So where do we go from here? We're determined to build a broadly supported 6502 resource magazine. We've recruited the continuing support of some of the best writers in the industry. Take a look through our continuing features...new this issue, and ENJOY COMPUTE! Happy New Year from all of us. We're looking forward to it.

The subscription price is $9.00 annually. Our next issue will be March/April.

A few articles in the JAN/FEB issue which are of interest include:

Inside the 2040 Disk Drive
A Visit to Commodore
The Programmer's Corner
Word Processors:
    A Users Manual Review
Saving Memory in Large Programs
The Deadly Linefeed
Null Return ("LINPUT") simula-
    tion for PET Users
EPROM Software Programmer
    for PET

We welcome your feedback and comments on our success. You can reach me by mail:

THE EDITOR
COMPUTE
P.O. Box 5119
Greensboro, N.C. 27403
By phone: (919) 272-4867

Books

PET Personal Computer Guide

By C. Donahue and J. Enger

Everything you want to know about your PET - from the "on" switch to the assembly language subroutine. This book outlines PET programming and includes an alphabetical reference to PET BASIC commands. It discusses applications, operations and special features of this popular personal computer. An invaluable reference book for all present and potential PET owners.

.....$15.00

PET and the IEEE 488 Bus (GPIB)

By E. Fisher and C.W. Jensen

This is the only complete guide available on interfacing PET to GPIB. Learn how to program the PET interface to control power supplies, signal sources, signal analyzers and other instruments. It's full of practical

information, as one of its authors assisted in the original design of the PET-GPIB interface.
.....$15.00

6502 Assembly Language Programming

By L. Leventhal

For the advanced programmer: increase the capabilities and performance of PET (and other 6502-based computers) by learning to program in assembly language.
.....$12.50

These Three Books are Available from:

OSBORN/McGraw-Hill
630 Bancroft Way, Dept. PET
Berkeley, CA 94710

APPLICATION

Controlling a Movie Camera from the PET Computer

by Elcomp Inc.

Have you ever wondered about the possibility of controlling a movie camera from your own computer? This program, along with a simple circuit using only a 7417 IC, will do that for any camera with an electronic shutter. You may set the frame rate from normal (18 frames per second) to as long as you wish! Or, if you wish, you may add other inputs and modify the program to click the shutter when the computer detects an event such as a switch closure, etc.

The circuit shown uses an inexpensive 7417 open collector buffer to interface to the camera. The circuit is driven from any of the bits of the PET's parallel output ports. One of the buffers is used to drive the other 5, in parallel to give maximum drive capability by using all the buffers on the chip.

The program shown turns on the circuit at intervals specified. Line 20 sets up the PET's output port to all output. Thus, any of the 8 bits may be used. Line 30 accepts the interval between switching. If you enter "5" when this question is posed, the computer will wait for 5 seconds between frames on the film. Line 40 prints out the speed factor, to tell you how much faster the film will appear when it is played back. For example, if you film a scene at 10 seconds between frames, the motion will appear 180 times faster when you play it back. If you play back the film at some speed other than 18 frames per second, then put that speed in the formula at the end of the line.

Line 50 sets the interval to be the number of increments on the PET's internal clock. Line 60 sets the variable "T" to be the time that the shutter should go off, by adding the interval IVL to the current time TI value (The PET's internal timer). Line 70 checks for any key on the PET's keyboard being depressed. If one is, then the timing loop is terminated and the program asks for another time interval. Line 80 tests the PET's internal timer TI to see if the time interval has elapsed. If it hasn't elapsed yet, then the program returns to line 70 for another test of the keyboard. Thus, the computer will cycle between lines 70 and 80 until either the time interval has elapsed or a key is depressed on the keyboard.

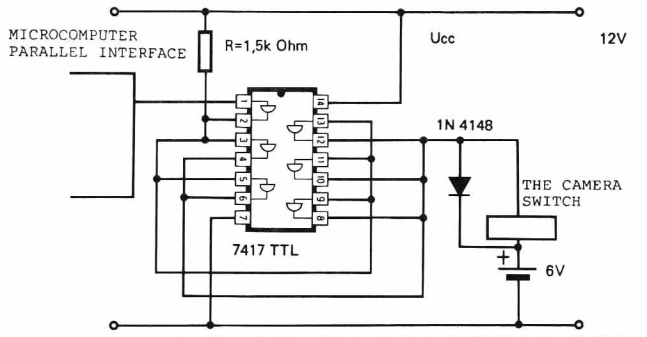
Line 90 is executed when the time interval has elapsed. It sets up the time of the next shutter opening immediately, so that no time is lost. Line 100 then turns on the bits on the port. The For Loop in line 110 delays the program long enough to keep the switch "on" for the proper period. You may have to adjust this for your camera. Line 120 turns the bit back off. Line 130 displays the current time on the PET's screen, so that you may see when the camera shutter is tripped. If you are running the program very quickly, then you may want to delete this line to speed up the loop. Line 140 returns to wait for the next frame interval.

Of course, this program and circuit do not have to be used only for a movie camera. You can use them for any timing application which does not overload the 7417's drive capability. If you need more drive capability, contact ELCOMP for more information.

The program is a good experiment for those interested in learning about the interface of the PET. For example, you can modify the program to stay "on" for a longer period by replacing line 110 with:

```
110 T2=TI+I2
112 IF T2 TI THEN 112
```

Set I2 equal to the number of 60ths of a second you wish the switch to stay on.



SWITCH DIAGRAM: FOR THE CONTROL OF A CAMERA THROUGH THE COMPUTER

```
10  REM PET MOVIE CAMERA INTERFACE
20  POKE 59459,255:REM SET UP PORT FOR OUTPUT ON ALL BITS
30  INPUT "SECONDS BETWEEN FRAMES";IVL
40  PRINT "SPEED FACTOR IS";IVL*18
50  IVL=IVL*60
60  T=TI+IVL
70  GET C$:IF C$<>""THEN 30
80  IF T>TI THEN 70:REM WAIT FOR TIME INTERVAL
90  T=TI+IVL:REM SET NEXT TIME INTERVAL
100  POKE 59457,255:REM TURN ON BIT
110  FOR K=1 TO 10:NEXT:REM WAIT FOR A WHILE-ADJUST TO
     CAMERA
120  POKE 59457,0:REM TURN OFF BIT
130  PRINT TI$,:DISPLAY SWITCHING TIME-DELETE IF CAMERA IS
     TO RUN FAST
140  GOTO 70:REM RETURN TO DO NEXT FRAME
```

For more information contact:

In Germany-

ELCOMP MICROCOMPUTER MAGAZINE
ING. W. HOFACKER GMBH
8 Munchen 75
Postfach 437

In the U.S.-

ELCOMP PUBLISHING, INC.
3873L Schaefer Ave.
Chino, CA 91710
(714) 627-9366

PROGRAMMING

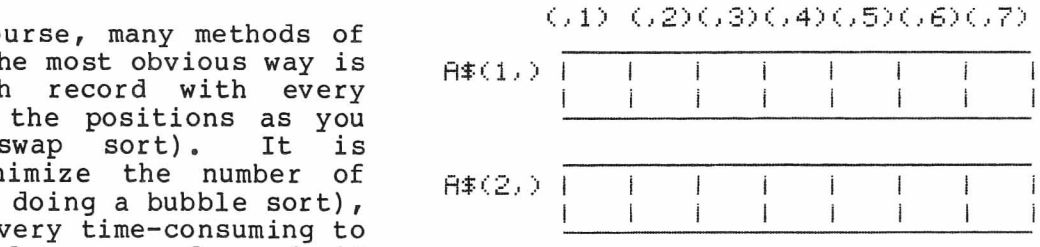
A Pointer Sort

BY Judy Bogart

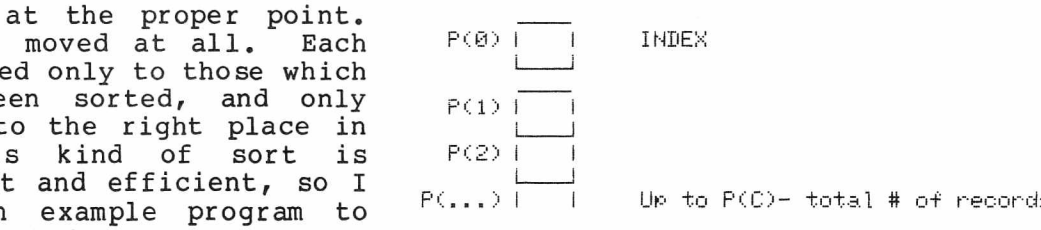
There are, of course, many methods of sorting data. The most obvious way is to compare each record with every other, changing the positions as you go along (a swap sort). It is possible to minimize the number of comparisons, (by doing a bubble sort), but it is still very time-consuming to move all that data around, and if there are several fields in each record, it is difficult to make sure that the fields remain in the same order while the records move.

One way to save time in a sort is to make a list of pointers, with each pointer corresponding to the key field of one record. You can then manipulate the pointers, so that they form a chain, with each one pointing to the next pointer. The location of each piece of data must be inserted into the chain at the proper point. The data is not moved at all. Each record is compared only to those which have already been sorted, and only until it comes to the right place in the list. This kind of sort is particularly fast and efficient, so I have written an example program to illustrate the technique.

There are two main parts to this program. The first part creates sample data and the second part sorts it. It is possible, with only a few modifications, to change the program to an input sort, so that it reads data from a disk or tape and then sorts it, or sorts it as it comes in. This has many applications in the real world, and the reader may wish to make these changes as an exercise. I have kept the function of sorting separate from that of reading data, in order to make the illustration clearer.
This program begins by putting random data into a variable called A$. A$ is a two-dimensional array. In my example it holds up to 50 records, of 7 fields each, so the dimensions are A$(50,7). Here is a picture of the first 2 records in A$:



Next to A$, which holds the data, we have a one-dimensional array called P, which holds the pointer list. P starts off with a header, or index, which tells us what the very first record in the list is, or where to start. This index is P(0). After that there is a P for each A$, so that in this example the dimension of P is P(51). Here is a picture of P:



When we have finished putting the data into A$, it is displayed on the screen. The first field contains the record number, the other six fields hold one random letter each. Now we can then begin to sort.

In order to sort, we have to establish which field we want to sort by. This will be the Key field, variable K. The records that we look at will all be A$ (wherever we are, K).

To begin the sort, we initialize P, the pointer list. No records have been sorted yet, so the first record is the smallest, and goes at the head of the list. Therefore, P(0), the head of the list, equals 1. This means that when we start to look at

the list, we look at record 1, or A$(1,K). In addition to pointing to a record in A$, the 1 also points to the next pointer; that is, the next one in the list will be held in P(1). Right now there is no next one. This is the last one. To indicate this, P(1) should hold an end-of-list marker, -1.

To help keep track of things, here is a list of our variables so far:

A$(C,7) : Two-dimensional array holds up to 50 records of 7 fields each
P(C+1) : List of pointers, with P(0) as the index, or head of list.
C : Total number of records.
K : Key field to sort by.

In order to compare each new record to the list, we have to keep track of two things, so we will introduce two more variables, C0 and C1. First, we have to know which record we are now comparing. C0 keeps track of the new record. Every time we insert a record into the list, C0 increments by one, so that we are then looking at the new record. Since the first record always goes at the head of the list, we start the comparisons with the second record. This means that the starting value of C0, when we begin our comparisons, should be 2.

The second counter keeps track of our place in the sorted list, so that we know which one to compare the new record to. Each time around, this counter, which is called C1, goes back to 0, so that we always start comparing at P(0), the head of the list. It then goes to the next one in the list, the one which the pointer points to. It becomes the number stored in P(0), which is, at the moment, 1, so that next time we look a P(1). Each time we make a comparison, C1=P(C1), so that we look at the next one in the chain. In this way C1 moves through the pointer list, following the chain of pointers.

Here is one way of looking at the sorted list:

1) P(0)
2) P(P(0))
3) P(P(P(0)))
4) P(P(P(P(0))))
etc.

Let's take a look at all these variables in their proper places. The actual comparison should look like this:

```
if A$(C0,K) < A$(C1,K) then...
```

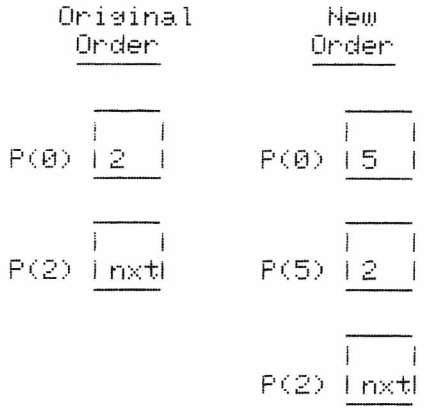
The first one is the newest record, the second one is the next one in the sorted list. In either case, we are only interested in the Key field.

Now what about the results of this comparison? If the new record is larger than the one in the list, it is lower on the list, so we go to the next one and compare again. We only have to act when it is smaller, as this indicates that we have found the right place, and the record must be inserted into the list.

There are three different kinds of insertions which may be necessary. The new record can be the smallest one, and go at the front of the list, or the largest one, and go at the end of the list. In most cases, it will be inserted somewhere in the middle of the list. There is a separate routine for each of these possibilities. For the convenience of the programmer, each routine prints a flag when it is executed, so you know where each record is being inserted.

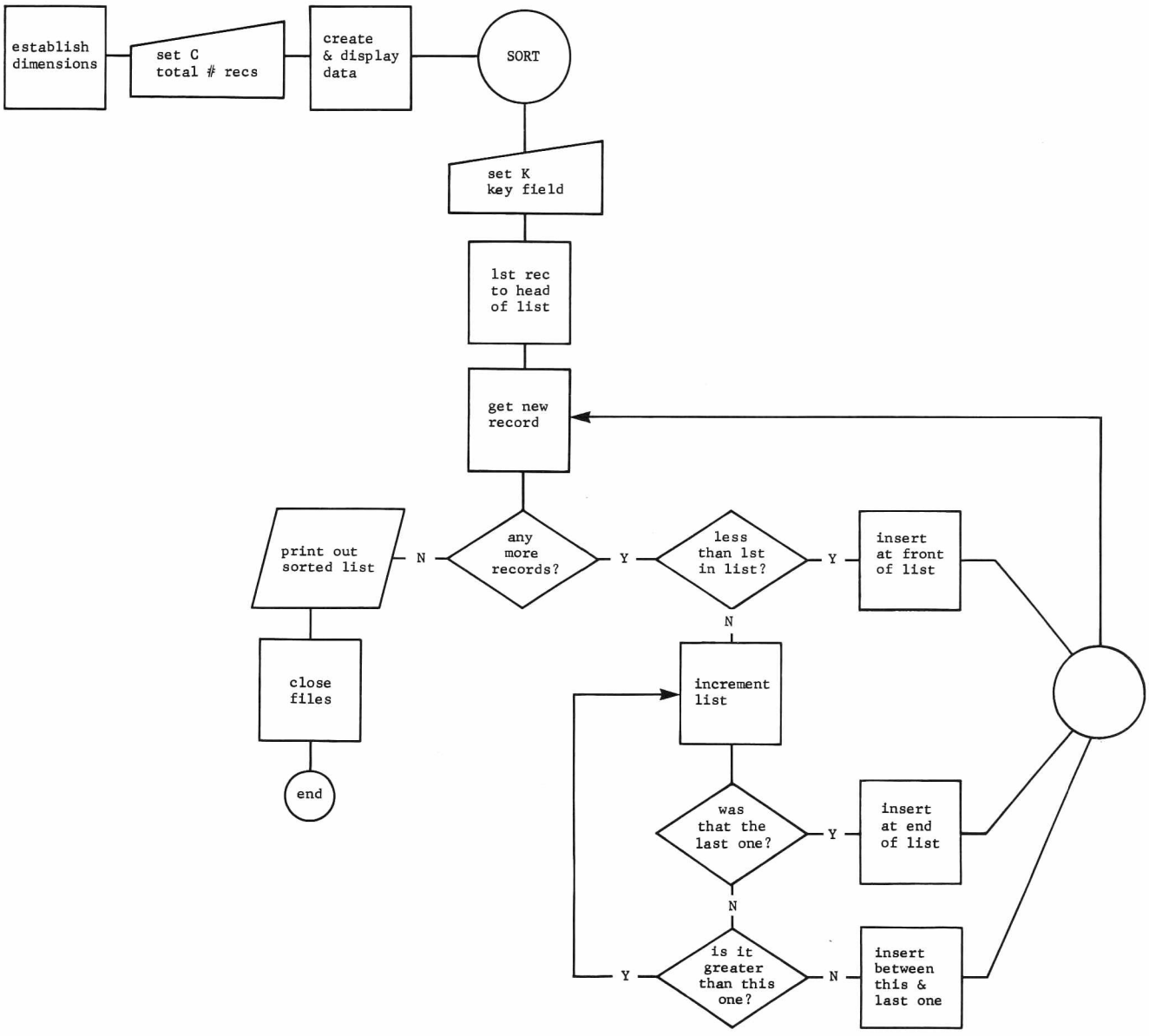
Let's take the first case. We compare the new record, C0, with the first one in the list, A$(P(0),K). It is less than the first one, so it is the smallest one so far, and we want to put it at the head of the list. P(0), the head of the list, has to point to C0, the new head, and the previous head goes where the new one points, at P(C0). If the incoming record is #5, and the previous header was #2, then C0=5 and P(0)=2. Now, P(0) will be 5, and P(5) will be 2. P(2) still points to the next one down, and everything else is still in the same order.

Here's a picture of the new list:



What if the new record goes at the end? The one that held the end-of-list marker, -1, before, must now point to C0, and P(C0) must now hold -1, showing that this is now the end of the list.

If the new record is in the middle of the chain, we won't find out until we have just passed the right place. The new record has to be inserted after the last one that was smaller, and before the first one which is larger. This introduces the need for one more counter, to keep track of the last one looked at in the list, or the previous C1. Therefore, just before C1 increments, we store it in CL.



To insert the new record into the middle of the pointer chain, P(CL) should hold C0, and P(C0) should hold CL. If the chain looked like this before:

```
P(0)=5
P(5)=2
P(2)=3
P(3)=-1
```

and we want to insert the new record, #6, between 2 and 3, the new chain will look like this:

```
 P(0)=5
 P(5)=2
** P(2)=6
** P(6)=3
 P(3)=-1
```

When C0, the new record, is greater than C, the total number of records, we know that all the records have been sorted, and it is time to print out. To print out each record in order we need a variable that goes through the sorted list in exactly the same way as Cl. To avoid confusion, we use N. N changes in the same way as Cl: that is, N becomes P(N). N keeps track of the place in the list, so that we print out A$(P(N),field). In order to print out all the fields of each record, we use a For-Next loop to print 7 fields for each N.

That's all, except for one final touch to make the print-out more readable. If the field being printed out is the same one that was sorted by, (the key), then it is printed in reverse field. This way you can tell at a glance whether the records have been sorted correctly.

After the program finishes sorting, it prints out the time it took to sort. Try some experiments. Change C, the total number of records,in line 35. Watch out for the dimensions. Try sorting by different fields. Try putting in different kinds of data. The pointer chain is an elusive concept, so play around until you feel comfortable with it. Good luck, programmers!

```
READY.

 1 REM ********************
 2 REM ** A POINTER SORT **
 3 REM ********************
 20 DIMA$(50,7),P(51)
 21 REM  ************************
 22 REM  * SORT UP TO 50 RECORDS*
 23 REM  *  EACH WITH 7 FIELDS  *
 24 REM  ************************
 29 REM   ***********************
 30 REM   * CREATE SAMPLE DATA *
 31 REM   ***********************
 32 REM   *C=TOTAL # OF RECORDS*
 33 REM   ***********************
 35 C=30:PRINT"GENERATING DATA"
 40 FORI=1TOC:A$(I,1)="RECORD"+RIGHT$
    ("    "+STR$(I),4)
 50 FORJ=2TO7:A$(I,J)=CHR$(INT(RND(1)
    *25)+65):NEXTJ,I
 60 REM  ***********************
 61 REM  *DISPLAY SAMPLE DATA*
 62 REM  ***********************
 70 FORI=1TOC:FORJ=1TO7:PRINTA$(I,J)
    ;" ";:NEXTJ:PRINT:NEXTI
 97 REM   ********************
 98 REM   * CHOOSE KEY FIELD *
 99 REM   ********************
 100 INPUT"WHICH FIELD DO YOU WANT TO
     SORT BY";K
 101 PRINT"OK, SORTING BY FIELD #"K
 102 TI$="000000"
 197 REM        **********
 198 REM        ** SORT **
 199 REM        **********
 200 C0=1:C1=0:P(0)=1:P(1)=-1
 250 C0=C0+1:C1=0
 260 IFC0>CTHEN1000
 270 IFA$(C0,K)<A$(P(C1),K)THEN450
 300 CL=C1:C1=P(C1):IFC1=-1THEN400
 310 IFA$(C0,K)>A$(C1,K)THEN300
 320 GOTO500
 400 REM ***************
 401 REM *INSERT AT END*
 402 REM ***************
 403 PRINT"END"
 410 P(CL)=C0:P(C0)=-1:GOTO250
 450 REM *****************
 451 REM *INSERT AT FRONT*
 452 REM *****************
 453 PRINT"FRONT"
 455 P(C0)=P(0):P(0)=C0:GOTO250
 500 REM *****************
 501 REM *INSERT IN CHAIN*
 502 REM *****************
 503 PRINT"MIDDLE"
 510 P(C0)=P(CL):P(CL)=C0:GOTO250
 1000 REM   ***********************
 1001 REM   ** FINISHED SORTING **
 1002 REM   ***********************
 1010 PRINT"FINISHED SORTING"
 1011 PRINT"SORTING TIME: "TI$
 1015 N=0
 1020 PRINT:FORI=1TO7
 1030 IFI=KTHENPRINT"■"A$(P(N),I);"■ ";
 1035 IFI<>KTHENPRINTA$(P(N),I)," ";
 1040 NEXT:N=P(N):IFP(N)=-1THEN2000
 1050 GOTO1020
 2000 PRINT:PRINT"END OF FILE":END
READY.
```

Editor's Note

Would you like to write programs in machine language with your machine language monitor, and have no idea where to begin? Here is an article which will show you some simple programs, using machine language routines, to help you get started.

Using the Subroutines of the PET Machine Language Monitor

By Dr. Zoltan Szepesi
2611 Saybrook Drive
Pittsburgh, PA 15235

Writing machine language programs with the help of the TIM (or Himondiss) Monitor is much simpler then POKEing in with a Basic program and it is more instructive than using an assembler which manipulates with decimal OP-codes and addresses. One can remember and handle the two digit hexadecimal OP-codes easier than the equivalent one-to-three digit long decimal values. Furthermore, addresses in hex are given by four digits, while in decimal (when used in the program) they have to be given in two parts needing two to six digits after a special calculation. Also, by not executing the machine language program through BASIC commands, one is not restricted by the BASIC's limitations. For example, adding more than 9 digit numbers and having the result printed out through a BASIC program is quite complicated, but it is straightforward in machine language.

The Machine Language Monitor serves for displaying and modifying memory locations and registers, for executing machine language programs and for loading and saving hexadecimal data (programs). At present, three very similar Monitors are in use: 1) the TIM Monitor on tape for the old PETs; 2) the Himondiss, which is the same as the previous but transferred to a higher memory location ($1A0F to $1FFF) and includes a disassembler program; 3) the Monitor in ROM built in the new 16/32K byte PETs and now available for the old PETs also.

There are subroutines in the Monitor, which get data and information into and results out of the machine language program. Table I lists these subroutines. Some of these are in the Monitor program, so they are the same for the different Monitors.

Since the Himondiss program is located $1600 higher then the taped Monitor program, the subroutines contained in the Monitors have the same address difference.

The higher location of the Himondiss has the advantage that one can have a BASIC program loaded in, together with the Monitor. To eliminate the interference between the BASIC part and the Himondiss and machine language program part, one can restrict the BASIC to use the memory below say 5632 decimal address. In the old 8K byte PET,

```
POKE134,0:POKE135,22
```

places the top of memory pointer allocated to BASIC at 22x256=5632.

SUBROUTINES	MNEMONICS	HEX ADDRESSES		
		TIM on tape	HIMONDISS	TIM in ROM
Type a character	WRT	FFD2	FFD2	FFD2
Input a character	RDT	FFCF	FFCF	FFCF
GET a character	GET	FFE4	FFE4	FFE4
Type a carriage ret.	CRLF	04F2	1AF2	FDD0
Type a space	SPACE	063A	1C3A	FDCD
Type a byte	WROB	0613	1C13	E775
Read a byte	RDOB	065E	1C5E	E7B6
ASCII to Hex in A	HEXIT	0685	1C85	E7E0

Table I: Subroutines in the different Monitors.

This is equivalent to $1600 to $1A00 and can be used for the machine language program without any interference, giving 1024 bytes free for this program. If one needs more bytes and not much memory is needed for the BASIC program, the available space can be extended by POKEing a smaller number in 135. (Lower value by every 4 gives 1024 bytes more.) In the new 16/32K byte PET similarly

```
POKE52,0:POKE53,M
```

would save for the machine language program locations from Mx256 to the top of the memory. (The Monitor program here is in ROM and it does not take any memory in the RAM).

However, if our machine language program is not too long it could be written in the second cassette buffer (address 826 to 1023) or in the first cassette buffer (address 634 to 825) if they are not used. This has a great advantage, that is, if some error in the program causes the PET to crash, the program in the buffers can be left intact, by using the RESET (not switching off the PET) as described on page 10, issue 6, volume 1, of PET USER NOTES. (The taped Monitor program is lost and needs to be reloaded.)

With the TIM on tape it is difficult to eliminate the interference between the BASIC and the machine language programs. However, one can transfer the Monitor program from the low memory location ($040F-076A) to a higher address as described in Kilobaud/Microcomputing (Kendal T. Rogers: Beefing up PET, KB/Microcomputing, October 1979, page 122). Also, the Himondiss could be obtained from the PET USER GROUP, P.O. Box 371, Montgomeryville, PA 18936.

Note, please, that after loading a machine language program through BASIC, one must enter NEW.

Returning to the subroutines of the Monitor, the basic rule is that the input to and the output from the subroutines have to be and are in the accumulator. A caution, when using indexed addressing: some of the subroutines use the X or the Y registers or both. Therefore, the index used in a program has to be saved before getting to the subroutine, and reloaded after the return from the subroutine.

In the following we show some examples for the use of these subroutines in a few simple programs written for the new 16K byte PET. For the old PET the subroutine addresses, if they are different, should be changed according to Table I.

Program No. 1 is a very simple program using the subroutines CRLF and RDT. After a carriage return it inputs the character from the keyboard and immediately writes it out.

```
Line #   LOC     CODE        LABEL     MNEMONICS          COMMENTS

0001     0000                          * =$033A          ;STARTING LOCATION
0002     033A                 CRLF     =$FDD0            ;PRINTS CARRIAGE RTN & LINEFD
0003     033A                 RDT      =$FFCF            ;READS KEY FROM KEYBOARD
0004     033A  20 D0 FD       START    JSR CRLF          ;CARRIAGE RETURN
0005     033D  20 CF FF                JSR RDT           ;READ A CHARACTER
0006     0340  00                      BRK               ;STOP
0007     0341  4C 3A 03                JMP $033A         ;JUMP TO START
0008     0344                          .END
```

Program No. 1: Input a character

After the program is loaded into memory, go to the Monitor and type: .G 033A. Now, press RETURN and type the text. Any number of characters can be written. When RETURN is pressed again, the program stops and displays the registers. If subroutine CRLF is left out of the program, the first .G 033A does not allow any

characters to be written because RETURN ($0D) is the input, causing the end of the program. However, the next command .G lets the program go on.

If one wants to save the written text in a given memory block, one has to load the ASCII values into the desired position as Program No. 2 shows.

```
Line #   LOC     CODE        LABEL     MNEMONICS          COMMENTS

0001     0000                          * =$033A          ;STARTING LOCATION
0002     033A                CRLF      =$FDD0            ;CARRIAGE RETURN/LINE FEED
0003     033A                RDT       =$FFCF            ;READ A CHARACTER
0004     033A                BASE      =$037B            ;STORAGE SPACE STARTS
0005     033A                RETURN    =$D               ;ASCII RETURN
0006     033A  A0 00         INPUT     LDY #0            ;SET Y TO 0
0007     033C  20 D0 FD                JSR CRLF          ;CARRIAGE RETURN
0008     033F  20 CF FF      START     JSR RDT           ;READ A CHARACTER
0009     0342  99 7B 03                STA BASE,Y        ;STORE IT
0010     0345  C9 0D                   CMP #RETURN       ;IF NEXT KEYSTROKE IS RETURN
0011     0347  F0 04                   BEQ END           ;THEN STOP
0012     0349  C8                      INY               ;IF NOT INCREMENT Y
0013     034A  4C 3F 03                JMP START         ;JUMP TO START
0014     034D  00            END       BRK               ;STOP
0015     034E  4C 3A 03                JMP INPUT         ;START OVER
0016     0351                          .END
```

Program No. 2: Input with saving the characters

Here we have to use a loop to be able to input more than one character (up to 80). Indexed addressing is used here, with the Y register (X could be used as well) for loading the characters in successive locations, starting at $037B. The RETURN key was used to stop the program. The STOP key (ASCII=03) is not recognised by RDT. However, if we use the GET subroutine in the program, we can stop the input by pressing STOP or SHIFT STOP. Load Run will be written out, but we are not lost. Using STOP (03) for CMP in address 0346 permits the use of the carriage return key, enabling you to start a new line when reading out the saved text.

```
Line #   LOC     CODE        LABEL     MNEMONICS          COMMENTS

0001     0000                          * =$035A          ;STARTING LOCATION
0002     035A                CRLF      =$FDD0            ;CARRIAGE RETURN/LINE FEED
0003     035A                WRT       =$FFD2            ;WRITE A CHARACTER
0004     035A                BASE      =$037B            ;STORAGE SPACE
0005     035A                RETURN    =$D               ;ASCII RETURN
0006     035A  A0 00         PRINT     LDY #0            ;SET Y TO 0
0007     035C  20 D0 FD                JSR CRLF          ;CARRIAGE RETURN
0008     035F  B9 7B 03      LOOP      LDA BASE,Y        ;LOAD STORED DATA INDEXED BY Y

0009     0362  C9 0D                   CMP #RETURN       ;IF LAST KEYSTROKE WAS RETURN
0010     0364  F0 07                   BEQ END           ;THEN STOP
0011     0366  20 D2 FF                JSR WRT           ;WRITE THE CHARACTER
0012     0369  C8                      INY               ;INCREMENT Y
0013     036A  4C 5F 03                JMP LOOP          ;JUMP BACK TO LOOP
0014     036D  00            END       BRK               ;STOP
0015     036E  4C 5A 03                JMP PRINT         ;JUMP TO START
0016     0371                          .END
```

Program No. 3: Print out saved text in Program No. 2

When we want to read out the text loaded previously with the input Program No. 2, we have to use subroutine WRT, as shown in Program No. 3.

Program No. 3 is very similar to the previous program, using a loop and indexed addressing, but the subroutine WRT was substituted for subroutine RDT, and LDA for STA. The two programs could be attached together by loading to address $034D:4C 5A 03 (JMP PRINT). Table II gives the machine language code of a little simplified combined program.

	0	1	2	3	4	5	6	7
.:033A	A0	00	20	D0	FD	20	CF	FF
.:0342	99	7B	03	C9	0D	F0	04	C8
.:034A	4C	3F	03	4C	5A	03	F0	F0
.:0352	0C	B1	01	20	D2	FF	C8	8C
.:035A	6A	03	4C	42	03	00	4C	3A

Table II: ML Code of Input-Print Program

The next subroutine "GET" works differently from the previous ones. First, there must be a loop to make time to type a character, as with the BASIC GET. Second, the GET subroutine uses both the X and Y registers, so if you want to use one of these registers in the program, you must save it before and reload it after the GET is performed. Third, the GET subroutine accepts the STOP KEY ($03). Fourth, it does not display the character, as with the BASIC GET. Therefore, if you want to see the text written, you must use the WRT subroutine after having saved the characters in a given location.

Program No. 4 lists a program using the GET subroutine, then saving the text and printing it with the WRT subroutine. This program makes use of the indirect indexed addressing. The starting address of the saving location (ADL) has to be loaded in zero page ($0001 and $0002 can be used if no USR command is expected to be applied in connection with the machine language program).

```
Line #   LOC     CODE        LABEL     MNEMONICS          COMMENTS

0001     0000                          * =$0001           ;STARTING LOCATION
0002     0001    6B 03       ADL       .WORD $036B        ;BUFFER ADDRESS
0003     0003                SAVEY     =$036A             ;STORAGE LOCATION FOR Y
0004     0003                          * =$033A           ;PROGRAM START LOCATION
0005     033A                CRLF      =$FID0             ;CARRIAGE RETURN/LINE FEED
0006     033A                GET       =$FFE4             ;GET A CHARACTER
0007     033A                STOP      =$3                ;ASCII STOP
0008     033A                WRT       =$FFD2             ;WRITE A CHARACTER
0009     033A    A0 00       START     LDY #0             ;SET Y TO 0
0010     033C    8C 6A 03              STY SAVEY          ;STORE AT LOCATION
0011     033F    20 D0 FD              JSR CRLF           ;CARRIAGE RETURN
0012     0342    20 E4 FF    LOOP      JSR GET            ;GET A CHARACTER
0013     0345    F0 FB                 BEQ LOOP           ;WAIT FOR KEYSTROKE
0014     0347    AC 6A 03              LDY SAVEY          ;LOAD IN Y
0015     034A    91 01                 STA (ADL),Y        ;STORE AT () INDIRECT INDEXED
0016     034C    C9 03                 CMP #STOP          ;IF IT WAS STOP
0017     034E    F0 0C                 BEQ END            ;THEN STOP
0018     0350    B1 01                 LDA (ADL),Y        ;OTHERWISE, LOAD IT
0019     0352    20 D2 FF              JSR WRT            ;WRITE CHARACTER
0020     0355    C8                    INY                ;INCREMENT Y
0021     0356    8C 6A 03              STY SAVEY          ;STORE Y
0022     0359    4C 42 03              JMP LOOP           ;JUMP BACK TO LOOP
0023     035C    00          END       BRK                ;STOP
0024     035D    4C 3A 03              JMP START          ;JUMP TO START
0025     0360                          .END
```

Program No. 4: GET and WRT subroutines for saving and writing text

Going through the program, we see that after the Y register is set to zero, its value is saved in location $036A. After the CRLF subroutine, the GET subroutine is executed with a loop ($0342 to $0349). When a character is typed in, the program jumps to $034A, loads back the Y register and by the indirect indexed addressing stores the typed character in the location given in zero page addresses $0001 and $0002 increased by Y. (Note that if the PET crashes and is RESET these addresses have to be reloaded.) In address $034F the typed byte, which is in the accumulator, is compared with 03 (ASCII "STOP"), and if the STOP key was pressed, the program jumps down 12 bytes to address 035F to break. If it was not the STOP key, the indirect indexed addressing in $0353 loads the accumulator from the location where the character was saved, then the WRT subroutine displays the character on the screen. After this, the Y register is increased by one and its value is saved at location $036A. Now the program jumps back to the GET subroutine ($0342) to repeat the process. Since there are 148 memory locations free for saving the characters ($03FF-036B=$94=148 decimal) 147 characters can be written at a time.

The remaining subroutines will be discussed briefly. Subroutine CRLF was already used in the previous programs. There is nothing special with subroutine SPACE. The next two subroutines RDOB and WROB are very similar to RDT and WRT. In program No. 2 and No. 3 substituting RDOB and WROB for RDT and WRT respectively, would work properly. However, to end the program one has to key in the byte 0D (the RETURN key does not do this), or any other byte written in the program. One does not need to save and reload the Y register when using these subroutines. However, since WROB has the X register in its program, you must save the value of X before starting and load it back after finishing WROB. In this program, 38 bytes can be saved if keyed in without space. (If the space key is used, the program takes it as one bit of a Hex byte and prints 0 for it.)

Subroutine HEXIT converts ASCII values of numbers 0 to 9 to their Hex value. I do not know how much more one can get from this subroutine.

Beside the listed subroutines in Table I, a very large number of routines are in the BASIC interpreter ROM which could be very useful in many machine language programs. An excellent booklet from Arnie Lee entitled, "PET Machine Language Guide", can be ordered from Abacus Software, P.O. Box 7211, Grand Rapids, MI 49510.

Glossary of Definitions

Through the courtesy of SYBEX Inc., CBM has been granted permission to excerpt portions of their MICROPROCESSOR LEXICON for publication in the PET Users Club Newsletter over the next year or so. The Lexicon is available at some computer stores, although it can be purchased directly from SYBEX in Berkeley, California at the following address - 2020 Milvia Street, Berkeley, CA 94704; in Europe at this address - 313 rue Lecourbe, 75015-Paris, France. The MICROPROCESSOR LEXICON sells for $2.95.

The Editor feels that these acronyms and definitiions will be of value to PET/CBM users and will help you understand some of the jargon that is encountered in the microcomputer industry.

alphanumeric The set of all alphabetic characters and numeric characters

alterable memory Storage medium which may be written into

alternating current Any signal which varies with time can be considered alternating current. Usually means that the current actually changes polarity with time

B Hexadecimal symbol for "1011"

B Second accumulator of 6800

background program In a multi-programming environment, low-priority program which operates when the processor is not doing anything else

backup copy Copy preserved (usually on a different medium) in case of loss of the original

bar code Coding of consumer products using combinations of bars of varying thicknesses. Designed to be read by an optical wand

base register Register containing base address for indexed-type referencing. The final address is obtained by adding a displacement

fetch (cycle) The first cycle in the fetch-decode-execute sequence of instruction execution. During the fetch cycle, the contents of the program counter are placed on the address bus, a Read signal is generated, and PC is incremented. The data word coming from the memory, i.e. the instruction which has been fetched will be gated into the Instruction Register of the Control Unit

File Management System Program designed to format and manage user files in a transparent way. Allows symbolic names, attributes, and manages the physical allocation of storage.

floating gate Technique used for UV-erasable EPROMs, where a silicon gate is isolated inside the silicon dioxide

indirect Addressing mode where the address of the location in memory to be read or written is contained in another place in memory or in a register

initialization Starting the processor in a known state

KB Kilo Bytes

linear regulator Power supply design where the voltage is held constant by dissipating 50% of the input voltage times the output current as a margin

line printer High speed printer capable of printing simultaneously a complete line (80 to 120 characters)

LISP List-oriented interactive language

machine language Set of binary codes, representing the instructions which can be directly executed by a processor

masked ROM Regular ROM produced by the usual masking process. Contrasted to a PROM

overflow Bit of the status register used to indicate whether 2's complement overflow has occurred. It denotes an overflow from bit 6 into bit 7 (i.e. the sign bit)

overlay Memory management technique where various routines occupy overlapping memory areas in succession

sector Triangular section of a disk surface. A block of data is addressed by its track and sector numbers. A typical disk sector has 128 bytes of data

simulator Program which behaves like the device it simulates, but slower. A simulated time counter allows the measurement of time. An MPU is easily simulated. I/O cannot be easily simulated, so that only the logic of a program can be tested with a simulator

SNR Signal to Noise Ratio

SP Stack Pointer

T Electrical network shaped like a "T" with one input, one output and one ground lead. Used with resistors for attenuators and capacitors and inductors for filters

TBMT Transmitter Buffer Empty. One of 5 status bits of standard UART. Goes to "1" when buffer may be reloaded.

VMOS Vertical MOS. Technology used to increase density of components per square mil where a V-shaped groove is cut in the silicon substrate

Zener Constant voltage reference diode

zero flag Status flag of the ALU indicating whether the previous operation was zero

---

Bits & Pieces

We have had many questions from users about the error message "File Data Error". This error occurs when the user program attempts to input a non-numeric character into a numeric variable. The following example demonstrates the problem:

```
10 OPEN 8,8,8,"0:FILEA,S,W"
20 FOR I=1 to 10
30 PRINT#8,I
40 NEXT
50 CLOSE8
60 OPEN 8,8,8,"0:FILEA,S,R"
70 INPUT#8,J:IF ST<>0 THEN 100
80 PRINT J
90 GOTO 70
100 CLOSE 8
110 END
```

This example prints the numbers one through ten to a disk file then attempts to read them back again. The data sent to the disk by the print statement in line 30 is of the following format:

<space>1<space><carriage rtn>
<line feed><space>2<space><carriage rtn><line feed>....

When the program attempts to read the data back a file data error occurs on the second execution of the input in line 70. The error is due to the fact that input is terminated by the carriage return character. Thus, on the second input the line feed character is found. The line feed is an invalid character for numeric input, causing the file data error.

This can be corrected by adding line 5 and changing line 30 as follows:

```
5 CR$=CHR$(13)
30 PRINT#8,I;CR$;
```

The variable CR$ contains a carriage return character and the trailing semicolon on line 30 suppresses the automatic carriage return/line feed sequence. Thus, there is no line feed on the disk to cause the error.

Watching a Cassette Load

By Jim Butterfield

It may not be too useful, but it's very satisfying to watch a program coming in from cassette tape. Much of what comes in will look like gibberish, since the program contains obscure things like pointers, flags and tokens. But it's interesting to see, and here's how you can do it.

Step 1: Load any Basic program on cassette 1. The program doesn't matter; the LOAD activity sets up certain internal things that will help us.

Step 2: Set up the cassette with any BASIC program ready to load. A short one would be good: that way you may catch the whole program on the screen. But any BASIC program will do.

Step 3: Set graphic mode with POKE 59468,14. This may help you spot a few recognizable pieces of your program.

Step 4: Give SYS 62894. PET will ask you to press PLAY. Do so, and in twenty seconds or so, PET will report FOUND.... and stop.

Step 5: Clear the screen so you'll get a better view of the program as it comes in. Now move the cursor down to a few lines from the bottom of the screen.

Step 6: Enter POKE 636,128:POKE 638,132:SYS 62403.

Step 7: Sit back and watch the program load to the screen. You won't be able to run it, of course, since it's in the wrong part of memory...but isn't it fascinating to watch?

PERIPHERALS AND ATTACHMENTS

The PET Printers 2022 & 2023

By Robert J. Fairbairn

This article was written to clarify the operation of Commodore 2022/2023 Printers with each of the PET/CBM computers. A sample program is employed to demonstrate these operational differences.

This program is designed to display the word "Commodore" on the screen and print it along with a program listing. The user should note that there are no difficulties when printing in the upper case/shifted graphics mode. However, when printing in the extended character set (lower/shifted upper case) with printers shipped through December, you will not be able to print shifted characters on the printer. In a printed listing the shifted character (capital letters, except on the 2001-8K will be lower case) appear as graphic characters.

2001-N & B

Commodore

PRINTER

```
 10 POKE59468,14
 20 OPEN4,4
 30 PRINT#4,"▒▒OMMODORE"
 40 PRINT"─OMMODORE"
 50 CMD4
 60 LIST
READY.
```

SCREEN

```
 10 poke59468,14
 20 open4,4
 30 print#4,"▒▒ommodore"
 40 print"Commodore"
 50 cmd4
 60 list
ready.
```

2001-8

Commodore

```
 10 POKE59468,14
 20 OPEN4,4
 30 PRINT#4,"▒▒OMMODORE"
 40 PRINT"C┌┐└┘┬┴_¯"
 50 CMD4
 60 LIST
READY.
```

(See Note 2)

```
 10 POKE59468,14
 20 OPEN4,4
 30 PRINT#4,"▒▒OMMODORE"
 40 PRINT"Commodore"
 50 CMD4
 60 LIST
READY.
```

This problem can be avoided (on printers from the first production run) when programming by abstaining from using capitalization (upper case for 2001-8K) in your programs. However, there is a new ROM available for your printer (see Note 1). This new firmware allows you to obtain a listing in lower/shifted upper case mode as shown by the following:

2001-N & B

Commodore

PRINTER

```
 10 poke59468,14
 15 open7,4,7:print#7:close7
 20 open4,4
 30 print#4,"■c■ommodore"
 40 print"Commodore"
 50 cmd4
 60 list
ready.
```

SCREEN

```
 10 poke59468,14
 15 open7,4,7:print#7:close7
 20 open4,4
 30 print#4,"■c■ommodore"
 40 print"Commodore"
 50 cmd4
 60 list
ready.
```

2001-8

Commodore

```
 10 poke59468,14
 15 open7,4,7:print#7:close7
 20 open4,4
 30 print#4,"■c■ommodore"
 40 print"cOMMODORE"
 50 cmd4
 60 list
ready.
```

(See Note 2)

```
 10 POKE59468,14
 15 OPEN7,4,7:PRINT#7:CLOSE7
 20 OPEN4,4
 30 PRINT#4,"■C■OMMODORE"
 40 PRINT"Commodore"
 50 CMD4
 60 LIST
READY.
```

To determine whether you have the new ROM, complete the following:

Model 2022 Depress the feed switch. If the paper feeds and the print head does not move you have the new ROM.

Model 2023 Open the printer and check the part number on the ROM.

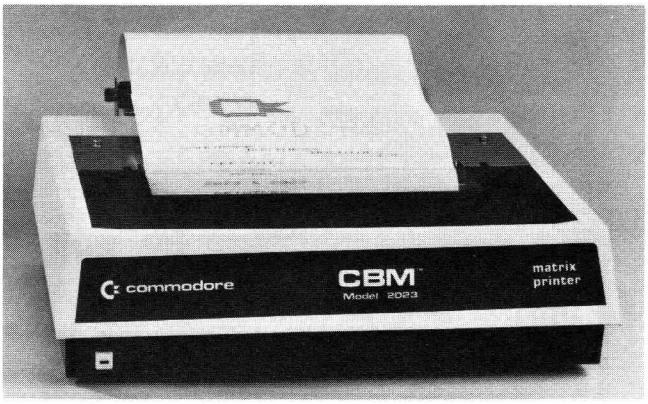
Note 2: You can obtain a ROM upgrade kit from your authorized Commodore dealer that will make your 2001-8K display exactly as a 2001 B&N series computer.

Notice that with the new printer ROM (P/N 901472-04) you can obtain a listing of the printer that matches your screen (except for the inversion shown on the 2001-8K).

Note 1: The new ROM for your printer can be ordered from your authorized Commodore dealer. The part number is 901472-04 and the ROM will be supplied free of charge when you supply your dealer with proof of purchase.

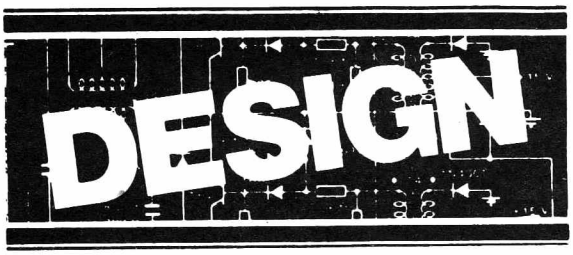
This new ROM has been shipped in the printers since the end of last year.

2022 Tractor Printer



2023 Matrix Printer

Electronic Engineering Times - Monday, January 7, 1980



Low-Cost IEEE-488 Systems Using The Commodore PET Microcomputer

By Tom DeSantis
Design Engineer
Keithley Instruments

The PET computer, introduced by Commodore Business Machines in 1977, is being used extensively as a low-cost IEEE-488 bus controller. Until recently however, the lack of inexpensive GPIB-compatible devices meant a test or measurement system would still cost several thousand dollars. This has changed with the emergence of microprocessors and low-cost LSI devices to implement the 488 Bus. A minimum system with a PET computer and digital multimeter can now start under $1500.

These low-cost systems are being used as research and design aids, where until recently a similar $10,000 plus system would not be justifiable. Applications include repetitive data logging, real-time number crunching, and instantaneous plotting using the PET's impressive graphics capability. Instruments with IEEE-488 output can be easily calibrated using the PET and a programmable source. Other applications include production and process control, where the PET can generate control signals on the bus.

Although the IEEE-488 bus is an adopted standard used by most computer and instrument manufacturers, implementation of the bus can often deviate from the standard. The PET is no exception. Presented here are the PET's features and peculiar implementation of the bus, with suggestions on how to use it more effectively.

All PET 2001 computers come standard with an IEEE bus interface. It is necessary to convert the PCB edge connector on the back of the PET to the standard's 24-pin connector, with an optional adapter cable. The PET conforms to the IEEE's electrical specifications, using Motorola 3446 devices to meet drive requirements.

Always acting as the system's controller, the PET asserts IFC (interface clear) for 100 ms, only when first turned on. Although much longer than the spec's 100 μs, this causes no problems unless it's necessary to assert IFC after power on. If so, many users have tied the IFC line to one of the parallel port outputs, and assert IFC by POKING to the output port. The REN (remote enable) line is always asserted in the PET. This means the PET cannot return a device from the local lockout state, to the local state—not a problem in most applications.

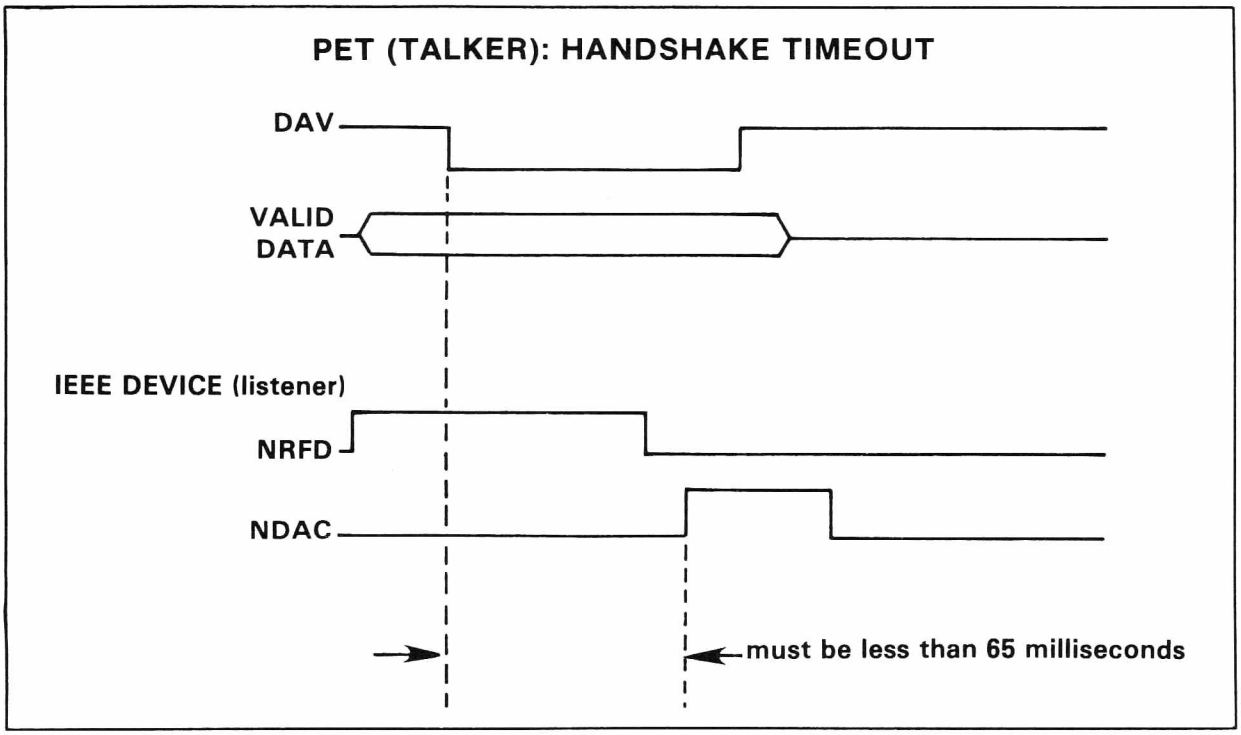
The EOI (End or Identify) line is asserted by the PET each time an output sequence is completed. The exact output is CARRIAGE RETURN, followed by LINE FEED with EOI asserted. Unfortunately, the line that blanks the screen during scrolling is also tied to the EOI line. In most applications this causes no problems using the bus. To prevent inadvertent strobing on this line, use the "CLR HOME" cursor key to keep the screen from scrolling.

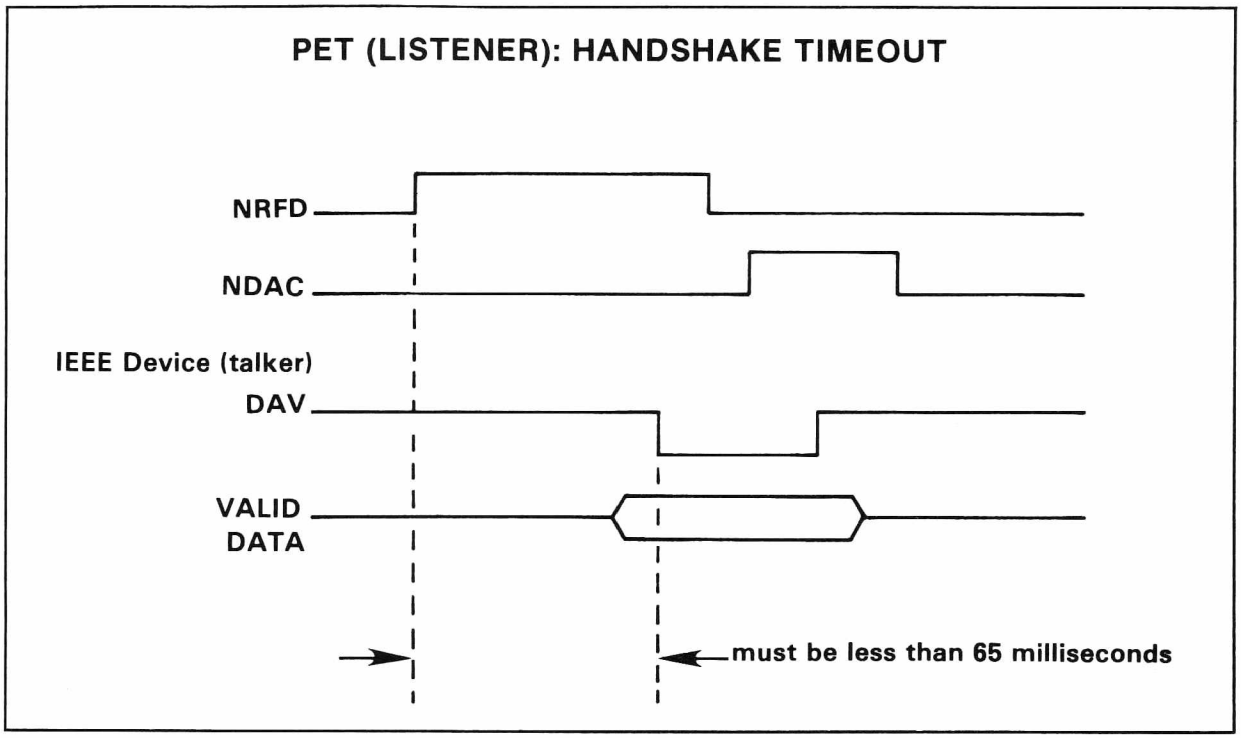
The PET accepts either a CARRIAGE RETURN or EOI as terminators for input data. This presents a problem when a device ends a data string with a CARRIAGE RETURN, followed by LINE FEED and EOI asserted (exactly like the PET's terminator). Once the PET receives the CARRIAGE RETURN, it assumes the last character's been sent, and never handshakes the LINE FEED. This leaves the TALKER in a mode waiting to complete the LINE FEED transfer. Earlier 8k PET's accepted only a CARRIAGE RETURN as the terminator, and didn't sense the EOI line.

Handshaking

The PET's most prominent deviation from IEEE standard involves a time-out on the handshake lines DAV, NRFD and NDAC. When the PET is a listener, it sets NRFD high to indicate it is ready to accept data. The device that's been addressed to talk must respond by setting DAV low, indicating its data lines now have valid data. If a device doesn't respond within 65 milliseconds, the PET sets a status bit indicating a time-out error has occurred, and continues to execute the next BASIC instruction. If the device addressed to talk (e.g., the digital multimeter) cannot respond within 65 ms due to its measurement period, the PET may not be listening when the device does respond.

By sensing the time-out status bit, the PET program can continually address the device to talk until it responds with valid data. This works only if the device addressed to talk has been designed





not to trigger a new measurement period each time it's been addressed, unless the present period has been completed.

A similar problem occurs when the PET is a talker and is addressing a device or sending out a command. Once all listeners have set NRFD high indicating they're ready to accept data, the PET will assert DAV and expect all devices to accept the data and respond by setting NDAC high within 65 ms. If this doesn't occur, the PET will again set a status bit indicating a write error.

Once the PET begins a bus transfer, it stops reading the keyboard until a complete handshake has occurred. If the handshake isn't completed after the 65-ms timeout has been satisfied, the

PET will not respond to keyboard inputs. The only simple way to regain operation is to turn the PET off and on, thus losing all programs in memory. This annoying feature makes the PET almost useless for designing or debugging IEEE bus instruments.

A Commodore design engineer suggests a method of "warm start" by applying a debounced, active low pulse to the NMI line (pin 6) of the 6502 μP. This returns control to the operating system, and leaves programs in RAM unaffected.

Many users have defeated the 65-ms timeout by replacing firmware in the PET's ROMs with modified firmware in EPROMs. All currently produced PETs accept 2716 memories. However, some earlier PC board revisions require slight modifications to accommodate the EPROMs. Commodore has indicated the "timeout" feature may be software selectable in future firmware revisions.

Attractive Feature

One of the most attractive features of the PET's bus implementation is its file management system. Before communicating with a device on the bus, a file is opened with a unique file number, primary address, optional secondary address and optional file name. Primary addresses 0-3 are reserved for the PET's keyboard, screen and cassette I/O. Address 4-30 are automatically assumed to be IEEE devices.

The advantage of this type of system is a logical file number can be associated with each primary-secondary address combination. Communicating with a device after its file has been opened involves an input/output instruction, followed by the file number and I/O variable or constant. The maximum number of files permitted by the operating system to be open at one time is ten. Exceeding this will cause the system to "bomb" completely, requiring power down to regain control.

PET's BASIC also supports a GET (not to be confused with Group Execute Trigger) command which inputs a single character, rather than an entire string. This is useful when a device sends data in a format not directly acceptable in BASIC, for example binary. The GET command is also useful when reading data from a keyboard or numeric pad, where single characters are sent asynchronously. An UNTALK & UNLISTEN are sent after each GET instruction.

Outputting data to the bus is accomplished using the PRINT & CMD command. The difference between the two is the PRINT sends an UNLISTEN at the end of a sequence, the CMD doesn't, leaving the device a listener on the BUS. With both commands, a comma and semicolon are not printed, but cause spaces to be outputted as if it were outputting to the video screen. It should be Noted that the abbreviation for PRINT (?) should not be used for outputting to IEEE devices.

The PET User Manual provides information necessary to write machine-language programs to control the IEEE management, handshake, and data lines. The ambitious programmer can execute SERVICE REQUEST, PARALLEL POLL, and several other bus functions not available in PET's BASIC. Commodore has indicated future software revisions will allow the assertion of ATN while sending data on the BUS. This will enable ADDRESSED and UNIVERSAL COMMANDS necessary to perform SERIAL POLL, PARALLEL POLL, GROUP EXECUTE TRIGGER, and many others. Hopefully the new software will be retrofittable to existing PETs.

Applications

The PET's value as an IEEE controller lies in its ability to manipulate data received on the bus, and to make decisions based on the data. Its awkwardness in implementing many bus features gears its usefulness to applications where speed and complexity are not required. An example would be sorting electronic devices to a statistical requirement (% deviation, high and low limits, etc.).

A digital multimeter capable of these computations would cost several thousand dollars, and limit the user to the instrument's firmware programs. A PET computer and a low-cost interfaceable DMM could do the same job for half the price. It would also give the user much more verstility to custom fit the program to his own needs. An interfaceable picoammeter ($<700) and the PET could be used to automatically sort LED's to several levels of luminous intensity. The picoammeter would measure very low currents from a photo detector, and send this data to the PET via the IEEE bus. The PET would determine to which luminescence category the device belongs, and either activate a relay or display the result to complete the sorting operation. The same instrument could measure leakage currents in semiconductors or leakage resistances in materials.

Other applications would be in production control, where the PET could monitor several parameters, and make decisions based on programmed limits. Temperature measurements, for example, can be made using a simple thermocouple, DMM, and a BASIC program to convert voltage to temperature.

A computer peripheral manufacturer is using the PET to monitor current in each of three phases of its plant's power transformers. Using the PET's real-time clock, 24-hour logging of power consumption and monitoring of line imbalances provide data used for energy conservation.

Small, low-cost systems have only begun to appear in research and industrial applications. By the end of 1980 there will assuredly be several microcomputers with IEEE-488 capability. The number of low-cost interfaceable instruments has already blossomed, with Keithley Instrument's recent introduction of four bus-compatible DMMs.

Ranging from $614 to $724, these interfaceable instruments measure dc voltages from 1 μV to 1 kV, TRMS ac voltages and current to 20 A, and currents as low as 1 pA. There is also a bus-compatible electrometer with sensitivity to 10^{-17}A. Look for a variety of interfaceable instruments to be introduced next year, with emphasis on low-cost small-system applications.

Reading A DMM

Here's an example how to get a reading from a digital voltmeter with 400-ms measurement period.

```
10 OPEN 2, 24, 01
20 INPUT #2, A$
30 IF ST=2 THEN 20
40 A=VAL (A$)
50 CLOSE 2
```

File number 2 (can be 1 through 255) is opened with primary address 24, secondary address 01. Line 20 addresses the voltmeter to talk, and sets A$ equal to the data received. If the device doesn't respond within 65 ms, the status byte ST will be set to 2, and the program proceeds to the next instruction. Since the voltmeter won't have data until 400 ms after being addressed, line 30 will cause the program to loop and re-address the device until it responds.

Assuming the voltmeter doesn't retrigger each time it gets addressed, a reading will be received after 400 ms and set equal to A$. Inputted data is normally set equal to a string variable, and then tested for overrange and status information before converted to a numeric variable (line 40). Line 50 closes the file after all data from that device has been inputted.

The SRQ function allows a device on the bus to request service from the controller. A printer, for example, might use the SRQ to indicate it's out of paper. When the controller senses the SRQ Line asserted, it send s SPE (serial poll enable) Universal Command on the bus, and then reads the status byte from each device. After determining who generated the SRQ, the controller sends an SPD (serial poll disable) command on the bus.

The PET's BASIC firmware doesn't support SRQ. However it is possible to use SRQ with only one device on the bus using PEEK & POKE instructions.

```
10 OPEN 1,9,2          Open file #1, primary
                       address 9, secondary
                       address 2

20 A=PEEK(59426)       Clear interrupt bit in
                       PIA control register

25 IF PEEK(59427)      Loop until SRQ
   AND 128 THEN 30

27 GO TO 25

30 INPUT #1, A$        Get data from device

40 A=PEEK(59426)       Clear SRQ bit in PIA

60 END
```

On the negative edge of an SRQ assertion, bit 7 in the PIAs control register will be set. Although the IEEE spec states the SRQ line will be level sensitive, there should be no problem with only one device on the bus.

Using SRQ with more than 1 device requires the SPE and SPD commands to determine who requested service. A machine language program is then necessary to assert ATN while sending SPE & SPD commands.

USER DIRECTORY & ANNOUNCEMENTS

Correction to CBM Floppy Disk User Manual

Page 17
Reference: SAVE"@dr:fn:",dn

The OPEN with @ sign does not work correctly and should not be used. Data from the file gets intermixed and happens on OPEN with replace, and SAVE with replace.

Options:

1. Scratch old file first then save new files.
2. - Save new file under a dummy name.
   -Scratch old file.
   -Rename dummy file to correct name.
3. Save file on other drive and use old file as a backup.

Page 16 and 17
SAVE and OPEN Write File Without Drive Number

The DOS searches for the filename starting on the most recently used drive. If not found on either drive as an existing file or as an unclosed file, the DOS assigns the file entry to the most recently used drive. The contents, however, are placed on the opposite drive.

The result is a file entry which is linked to space on the diskette which may be used by other files or not at all. The BAM of the opposite drive is updated by the DOS.

The contents of the other files on each diskette are not altered, but care should be taken in the recovery procedure. If either drive is empty or un-INITIALIZED, the process will halt, leaving the file unclosed.

Recovery Procedure:

The safest way to recover is to properly save the file on another diskette, then copy all files of interest from the diskette with the bad entry to another diskette. The opposite diskette may be restored with the verify command.

An easier but less guaranteed method is to scratch the file entry and then restore both disks with the verify command.

Page 19 (and 25)
Formatting With Write Protect On(NEW With ID or Duplicate)

If the write protect switch is depressed while formatting a diskette in that drive, the system will ignore the signal and attempt to write. After the system detects that no writing is taking place, an error condition is generated, but the write signal line is left on. Any subsequent operation will result in writing to the disk involved in the operation.

Since the write protect is also a hardware disable, any protected diskette will not be disturbed. To recover from this situation, power reset the 2040.

Page 25
DUPLICATE-Write Error

If a write error is encountered in the DUP command, the 2040 will attempt the write continuously. This indicates probable media failure and the diskette should be discarded. This problem may be detected by watching the R/W head or listening carefully to the disk. If the click sound of the head changing tracks is not noticed after 1 minute, then more than likely the problem has occurred.

Page 25
VALIDATE

The manual states that the diskette should be INITIALIZED immediately after a Validate error. If this is not done, a loss of file contents will be inevitable, since the BAM in memory is left in an indeterminate state.

Page 29
RENAME-File Not Renamed

This problem has been observed but there is no solution. Usually adding a file to the diskette will allow RENAME to work. Also, copying the file to the new name will also work.

Page 43
BLOCK-ALLOCATE and BLOCK-FREE, Illegal Track or Sector Requested

The B-A & B-F commands will generate an error message which overlays part of the previous message. The position is dependent on the length of the incoming command. For example, if the previous message was 00, OK, 00, 00 and the command was 38 characters long, subsequent inputs would still access the previous message.

Care should be taken when transmitting these two commands. It should be as short as possible and Track & Sector should be legal values. The following table indicates the legal ranges.

Track	Sector
1-17	0-20
18-24	0-19
25-30	0-17
31-35	0-16

Page 43
BUFFER-POINTER at 0

The B commands are intended for Record oriented disk access. Since position 0 is used as the pointer to the last valid data byte in the record, it is not normally accessed. If it is necessary to access this byte, (for gaining access to a track link for example) B-P at 0 will allow access (GET# or PRINT#) only if the last character pointer is not 255, so access to 0 position would be impossible.

Solution:

```
OPEN1,8,15
OPEN2,8,2,"#0"
PRINT#1,"M-R"CHR$(0)CHR$(17)
GET#1,A$:REM 1st Byte of Buffer
```

Page 44
MEMORY-READ GET # without EOI

The Memory-Read command is intended to provide an unlimited access to any part of the file interface controller's memory. The byte read from the memory is placed in the error buffer and the character count is set to one. EOI is not sent with the byte. Consequently, an INPUT# from the Error channel (SA=15) will not terminate. If M-R is to be executed, only a GET# should be used in accessing the byte.

Services Offered

One of the major advantages in being a member of the PET USERS CLUB is the ability to get hold of PET/CBM related Software and ideas. Although our Master Library of programs is now growing, we get frequent Software inquiries for a wide range of applications.

In this issue, we have included the current USERS DIRECTORY, containing lists of people writing Software, publishing literature or starting local PET Groups. If you would like to use your PET for fun and profit, why not offer personal tutoring in PET programming to new PET/CBM owners. Alternatively, if you require a program to be written for you, ask for contacts via the USERS DIRECTORY. The

possibilities are endless. Please write to the EDITOR, COMMODORE PET USERS CLUB, at our current address below.

To include your name in the USERS DIRECTORY, please complete the following form:

To include as many contacts as possible, we must restrict each USER to only one line of description.

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Modesto 95351
209-529-9967

COMPUTER FORUM
14052 E. Firestone Blvd
Santa Fe Springs 90670
213-921-2111

COMPUTERLAND
1625 El Camino Real
Belmont 94002
415-595-4232

COMPUTERLAND
6743 Dublin Blvd.
Dublin 94566
415-828-8090

COMPUTERLAND
2992 Navajo Road
El Cajon 92020
741-464-5656

COMPUTERLAND
11074 San Pablo Ave
El Cerrito 94530
415-233-5010

COMPUTERLAND
22634 Foothill Blvd.
Hayward 94542
415-538-8080

COMPUTERLAND
6840 La Cienega Blvd
Inglewood 90302
213-776-8080

COMPUTERLAND
4546 El Camino Real
Los Altos 94022
415-941-8154

COMPUTERLAND
24001 Via Fabricante
Mission Viejo 92691
714-770-0131

COMPUTERLAND
81 North Lake St.
Pasadena 91101
213-449-3205

COMPUTERLAND
1537 Howe Ave #106
Sacramento 95825
916-920-8981

COMPUTERLAND
289 E. Highlands Ave
San Bernardino 92404
714-886-6838

COMPUTERLAND
4233 Convoy St
San Diego 92111
714-560-9912

COMPUTERLAND
2272 Market St
San Francisco 94114
415-864-8080

COMPUTERLAND
117 Fremont St.
San Francisco 94105
415-546-1592

COMPUTERLAND
1077 Saratoga Sunnyvale Rd.
San Jose 95129
408-253-8080

COMPUTERLAND
1930 4Th Street
San Rafael 94901
415-459-1767

COMPUTERLAND
223 S. Broadway
Santa Maria 93454
805-928-1919

COMPUTERLAND
611 Fifth St.
Santa Rosa 95404
707-528-1775

COMPUTERLAND
171 E. Thousand Oaks Blvd.
Thousand Oaks 91360
805-495-3554

COMPUTERLAND
104 W. First St
Tustin 92680
714-544-0542

COMPUTERLAND
1815 Ygnacio Valley Rd
Walnut Creek 94598
415-935-6502

* COMPUTER PATHWAYS
12050 Nevada Cty. Hway #100
Grass Valley 95945
916-273-8474

* COMPUTER PLACE
2539 W. Sepulveda Blvd
Torrance 90505
213-325-4754

THE COMPUTER STORE
820 Broadway
Santa Monica 90401
213-451-0713

* COMPUTER TIMESHARING CORP
5560 Ruffin Rd
San Diego 92123
714-565-0505

* COMPUTER WORLD, INC
3808 W. Verdugo Ave
Burbank 91505
213-848-5521

COMPUTER WORLD
15818 Hawthorne
Lawndale 90260
213-370-4842

* COMPUTER WORLD, INC
5848 Sepulveda Blvd
Van Nuys 91411
213-786-7411

* COMPUTER WORLD, INC
6789 Westminster Ave
Westminster 92683
714-898-8330

* DATA EQUIPMENT SUPPLY
8315 Firestone Blvd
Downey 90241
213-923-9361

EDUCATIONAL MICRO SYSTEMS
1527 - 28th St
Sacramento 95816
916-452-3609

* GRASS VALLEY COMPUTER
18430 Jayhawk Dr
Smartville 95977
916-272-2793

* INT'L INSTITUTE OF NATIONAL HEALTH
7422 Mountjoy
Huntington Beach 92647
714-848-0774

JAY-KERN ELECTRONICS
1135 Columbus
Bakersfield 93305
805-871-5800

K-SMITH ASSOCIATES
11 Mast Court
Sacramento 95831
916-392-0317

* LANTOR, INC
8055 Manchester Ave
Playa del Rey 90291
213-821-0642

LYON TV
19515 Village Dr.
Sonora 95370
209-532-4894

* MATTHEWS TV & STEREO
6040 Mission St
Daly City 94014
415-992-5400

* MR. CALCULATOR
160 E. El Camino Real
Mt. View 94040
415-962-0335

MR. CALCULATOR
39 Town & Country Village
Palo Alto 94301
415-328-0740

* MR. CALCULATOR
55 Third St
San Francisco 94108
415-543-1541

* MR. CALCULATOR
318 Town & Country Village
San Jose 95128
408-246-5710

PARADYME CONSUMER ELECTRONICS
404 Second St
Davis 95616
916-758-5210

PC COMPUTERS
10166 San Pablo Ave
El Cerrito 94530
415-527-6657

* PROGRAMMABLE ELECTRONICS
1748 W. Chapman Ave
Orange 92668
714-978-6587

RADIO MART
1075 Cypress Ave
Redding 96001
916-241-3030

SUPER BRAIN
1646 Westwood Blvd
Westwood 96137
213-470-1318

COLORADO

AMPTEC
2310 Providence Circle
Colorado Springs 80909
303-597-5384

AMPTEC
5975 N. Broadway
Denver 80216
303-571-0833

BYTE SHOP
300 E. Foothills Pkway
Ft. Collins 80525
303-223-4000

BYTE SHOP
3101 Walnut St
Boulder 80301
303-444-6550

BYTE SHOP
970 S. Oneida
Denver 80224
303-399-8995

COMPUTERLAND
8749 Wadsworth Blvd.
Aryada 80005
303-420-1877

COMPUTERLAND
4543 Templeton Gap Rd
Colorado Springs 80909
393-574-4150

COMPUTERLAND
2422 S. Colorado Blvd
Denver 80222
303-759-4685

* MICRO COMPUTER INDUSTRIES
1532 E. Mulberry
Ft. Collins 80521
303-221-1955

MICRO WORLD ELECTRONIX
6340 W. Mississippi
Lakewood 80226
303-936-4407

NEIGHBORHOOD COMPUTER STORE
13045 W. Alameda Parkway
Lakewood 80215
303-988-9140

CONNECTICUT

COMPUTERLAND
1700 Post Rd. Heritage Sq.
Fairfield 06430
203-255-9252

COMPUTERLAND
55 Pratt Street
Hartford 06103
203-727-1857

CONNECTICUT MICROCOMPUTER
150 Pocono Road
Brookfield 06804
203-775-9659

HAASE OFFICE MACHINES
906 Washington Blvd
Stamford 06901
203-359-4680

* MULTI BUSINESS COMPUTER SYSTEMS
28 Marlborough St
Portland 06480
203-342-2747

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COMPUTERLAND
Astro Shopping Center
Newark 19771
302-738-9565

DISTRICT OF COLUMBIA

COMPUTER EMPORIUM
1990 K Street NW
Washington, D.C. 20006
202-466-2030

COMPUTERS FOR BUSINESS
The Watergate, Suite 623
600 New Hampshire Av. NW
Washington D.C. 20037
202-338-9109

FLORIDA

ACCURATE COMPUTING SERVICE
785 N. Lake Blvd
North Palm Beach 33408
305-842-4900

* COMPUTER CENTER
6578 Central Ave
St. Petersburg 33707
813-343-1396

COMPUTERLAND
500 E. Spanish River Blvd
Boca Raton 33432
305-368-1122

COMPUTERLAND
274 Alhambra Circle
Coral Gables 33134
305-442-4112

COMPUTERLAND
3963 N. Federal Highway
Ft. Lauderdale 33308
305-566-0776

COMPUTERLAND
2777-6 University Blvd
Jacksonville 32217
904-731-2471

COMPUTERLAND
7374 S. Tamiami Trail
Sarasota 33581
813-921-7800

COMPUTERLAND
1520 E. Fowler Ave
Tampa 33612
813-971-1680

* COMPUTERS FOR YOU
3608 W. Broward Blvd
Ft. Lauderdale 33312
305-581-8945

* FLORIDA BOOK STORE
1614 W. University Ave
Gainesville 32604
904-376-6066

* FOCUS SCIENTIFIC
224 N. Federal Highway
Ft. Lauderdale 33301
305-462-1010

FOCUS SCIENTIFIC
1601 Biscayne Blvd
Miami 33132
305-358-3948

GRICE ELECTRONICS
417A Mary Esther Cutoff
Ft. Walton Beach 32548
504-244-3168

GRICE ELECTRONICS
7171 N. Davis Highway
Pensacola 32504
904-476-0047

GRICE ELECTRONICS
266 Brent Lane
P.O. Box 1911
Pensacola 32589
904-477-8100

Authorized Dealers

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3341 NW 82nd Ave
Miami 33122
305-592-5355

MONEY MANAGEMENT
904 Oakview Ave
Clearwater 33516
813-443-5073

ORLANDO ELECTRONICS CO
2356 W Oak Ridge Road
Orlando 32809
305-855-1010

PROFIT CONCEPTS, INC
3300 University Dr
Coral Springs 33065
305-753-8303

UNITED SYSTEMS & SOFTWARE
P O Box 117
Winter Park 32789
305-647-2251

GEORGIA

ACTION BUSINESS MACHINES
1684 N Atwood Drive
Macon 31204
912-474-3333

*ANCRONA
3330 Piedmont Rd
Atlanta 30305
404-261-7100

ATLANTA COMPUTER MART
5091-B Buford Highway
Atlanta 30340
404-455-0647

COMPUTERLAND
2423 Cobb Parkway
Smyrna 30080
404-953-0406

THE LOGIC STORE
3050 Macon Road
Columbus 31906
404-568-0197

MERCHANT'S BUSINESS MACHINES
18 Executive Dr NE
Atlanta 30329
404-633-1027

PERIMETER OFFICE SUPPLY
& EQUIP INC
6950 Peachtree Ind Blvd., Suite F
Norcross 30071
404-449-5832

HAWAII

COMPUTERLAND
567 S King St
Honolulu 96813
808-521-8002

IDAHO

*ELECTRONIC SPECIALITIES
8411 Fairview Ave
Boise 83704
208-376-5040

*WORLD TOY & HOBBYCRAFT
7820 Fairview Ave
Boise 83704
208-376-3561

ILLINOIS

*APPLETREE STEREO
1022 W Lincoln Hway
DeKalb 60115
815-758-2442

*APPLETREE STEREO
117-119 E Beaufort St
Normal 61761
309-452-4215

*APPLETREE STEREO
1645 N Alpine
Rockford 61107
815-226-9826

BLACKHAWK OFFICE SUPPLIES
420 First St
Dixon 61021
815-288-3311

BYTE SHOP
5 S LaGrange Road
LaGrange 60525
312-579-0920

BYTE SHOP
1602 S Neil St
Urbana 61820
217-352-2323

CHICAGO SYSTEMS, INC
2200 Lawrence Ave
Chicago 60625
312-561-6137

COMPUTERLAND
50 E Rand Rd
Arlington Heights 60004
312-255-6488

COMPUTERLAND
136 W Ogden Ave
Downers Grove 60515
312-964-7762

COMPUTERLAND
1500 S Lake St
Mundelein 60060
312-949-1300

COMPUTERLAND
9511 N Milwaukee Ave
Niles 60648
312-967-1714

COMPUTERLAND
10935 S Cicero Ave
Oak Lawn 60453
312-422-8080

COMPUTERLAND
4507 N Sterling
Peoria 61614
309-688-6252

*FINANCIAL DYNAMICS
530 Park Ave
River Forest 60305
312-771-5441

*LILLIPUTE COMPUTER MART
4446 Oakton St
Skokie 60076
312-674-1383

*KAPPEL'S COMPUTER STORE
125 E Main St
Belleville 62220
618-277-2334

MICOBUS
6146 N Lincoln Ave
Chicago 60645
312-583-8358

*ORCUTT BUSINESS MACHINES
431 First Street
LaSalle 61301
815-224-2774

*RUHL & ASSOCIATES
24 W Stevenson
Freeport 61032
815-235-7800

*SCHAFF SYSTEMS & ENGINEERS
Rts 25 & 62
Algonquin 60102
312-658-5013

*STEREOTRONIC INDUSTRIES
Wadsworth Rd & North Ave
Zion 60099
312-336-2222

SYSTEMS INC
2200 W Lawrence Ave
Chicago 60625
312-561-6137

INDIANA

*AUDIO SPECIALISTS
405 N Michigan
South Bend 46601
219-234-5001

*COMMUNICATIONS ELECTRONICS
2204 Grand Ave
Connersville 47331
317-825-6893

*THE COMPUTER CENTER
19819 Orchard St
South Bend 46637
219-272-0252

COMPUTERLAND
9423 N Meridian
Indianapolis 46260
317-848-2546

COMPUTERLAND
19 W 80th Place
Merrillville 46410
219-769-8020

*FT WAYNE ELECTRONICS
3606 Maumee Ave
Ft Wayne 46803
219-423-3422

*GRAHAM ELECTRONIC SUPPLY
23rd and Columbia
Anderson 46014
317-644-3381

*GRAHAM ELECTRONIC SUPPLY
133 S Pennsylvania St
Indianapolis 46204
317-634-8202

*GRAHAM ELECTRONIC SUPPLY
10202 E Washington St
Indianapolis 46204
317-899-4110

*GRAHAM ELECTRONIC SUPPLY
408 North Street
Lafayette 47902
317-742-4006

*GRAHAM ELECTRONIC SUPPLY
Tippecanoe Mall-Sagamore E
Lafayette 47905
317-447-9756

*STEWART BUSINESS MACHINES
4778 Broadway
Gary 46408
219-884-9474

IOWA

*THE COMPUTER CENTER
302 Commercial
Waterloo 50701
319-232-9504

CYBERIA, INC
2330 Lincoln Way
Ames 50010
515-292-7634

THE MEMORY BANK
4128 Brady St
Davenport 52806
319-386-3330

KANSAS

CENTRAL OFFICE SYSTEMS
307 N Main
Hutchinson 67501
316-663-5121

COMPUTERLAND
10049 Santa Fe Drive
Overland Park 66212
913-492-8882

COMPUTER SYSTEMS DESIGN
906 N Main
Wichita 67214
316-265-1120

COMPUTER VIDEO ROOM
7105 W 105th St
Overland Park 66212
913-648-7105

MAIN ELECTRONICS
225 Ida
Wichita 67211
316-267-3581

PERSONAL COMPUTING CENTER
3819 W 95th St
Overland Park 66212
913-649-5942

KENTUCKY

*BARNEY MILLER'S INC
232 E Main St
Lexington 40507
606-252-2216

COMPUTERLAND
10414 Shelbyville Rd
Louisville 40223
502-245-8288

MICROTECH, INC
1127 S 8th St
Louisville 40203
502-587-8099

LOUISIANA

COMPUTER PLACE
3340 Highland Road
Baton Rouge 70812
504-387-0072

COMPUTER PLACE
1904 Pinook Rd, #202
Lafayette 70508
318-232-4097

*COMPUTER SHOPPE
3225 Danny Park
Metairie 70002
504-454-6600

COMPUTER SHOPPE
12A West Bank Expressway
Gretna 70053
504-366-0687

EXPANDED TECHNOLOGIES, INC
3883 Greenway Place
Shreveport 71105
318-868-5144

*FREEMAN ELECTRONICS
708 N 7th St
West Monroe 71291
318-388-2312

VIDEO SPECTRUM
6601 Veterans Memorial Blvd
Metairie 70003
504-885-6527

MAINE

C N A
37 High St
Lewiston 04240
207-784-6961

MARYLAND

COMPUTERLAND
16065 Frederick Road
Rockville 20855
301-948-7676

COMPUTERS, ETC
13A Allegheny Ave
Towson 21204
301-296-0520

MAC'S MERCHANDISE MART
7140 Fairbrook Rd
Baltimore 21207
301-298-0473

*THE MATH BOX, INC
2621 University Blvd W
Wheaton 20902
301-933-8770

YOUR OWN COMPUTER, LTD
10678 Campus Way South
Largo 20870
301-350-6680

MASSACHUSETTS

COMPUMART CORP
270 Third St
Cambridge 02142
617-491-2700

COMPUTERLAND
214 Worcester St
Wellesley 02181
617-235-6252

COMPUTER SHOP 11000011
288 Norfolk St
Cambridge 02139
617-661-2670

C P U Shop
39 Pleasant St
Charlestown 02129
617-242-3350

GAMELLI'S MUSIC VILLAGE
66 Myron St
West Springfield 01089
413-739-3809

I A C LIMITED
141 Addison
Boston 02128
617-567-2517

*NEW ENGLAND ELECTRONICS
679 Highland Ave
Needham 02192
617-449-1760

*RETAIL COMPUTER CENTER
455 Center St
Ludlow 01056
413-589-0106

THE SOUND COMPANY
Fairfield Mall
Chicopee 01020
413-593-5330

THE SOUND COMPANY
447 Sumner Avenue
Springfield 01108
413-736-3626

THE SOUND COMPANY
The Westfield Shops
423 E Main St
Westfield 01085
413-568-1160

MICHIGAN

THE COMPUTER CENTER
28251 Ford Rd
Garden City 48135
313-422-2570

*COMPUTER HOUSE
1407 Clinton Road
Jackson 49202
517 783-5343

COMPUTERLAND
2927 - 28TH St SE
Kentwood 49508
616-942-2931

COMPUTERLAND
301 S Livernois
Rochester 48063
313-652-9000

COMPUTERLAND
29763 Northwestern Hway
Southfield 48034
313-356-8111

*COMPUTERMART OF ROYAL OAK
560 W 14 Mile Road
Clawson 48017
313-288-0040

*COMPUTRONIX
423 Saginaw Rd
Midland 48640
517-631-8060

HILTON FROST INC
162 Apple Ave
Muskegon 49442
616-722-6757

*MAIN SYSTEMS, INC
1161 N Ballenger Hway #8
Flint 48504
313-232-3130

MATRIX, INC
1241 N Main
Ann Arbor 48104
313-663-6677

NATIONAL MICRO
1094 Third St
Muskegon 49440
616-722-2929

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*NEWMAN COMPUTER EXCHANGE
1250 N. Main St.
Ann Arbor 48107
313-994-3200

MINNESOTA

*COMPUTER DEPOT
3615 W. 70th St.
Minneapolis 55436
612-927-5601

COMPUTERLAND
8070 Morgan Circle Dr.
Bloomington 55431
612-882-1474

COMPUTERLAND
11319 Highway 7
Hopkins 55343
612-933-8822

*DIGITAL DEN
2138 Burnsville Center
Burnsville 55337
612-435-5445

*DIGITAL DEN
1009 Maplewood Mall
Maplewood 55109
612-770-3975

*MINNESOTA MICRO SYSTEMS
514 Cedar Ave. South
Minneapolis 55454
612-338-5604

*SCHAAK ELECTRONICS
1415 Mendota Heights Rd.
St. Paul 55120
612-454-6830

ZIM COMPUTERS
5717 Xeres Ave.
Brooklyn Center 55429
612-560-0336

MISSISSIPPI

MISSISSIPPI MICROS INC.
Mart 51 - 1700 Terry Rd.
Jackson 39204
601-948-7846

MISSOURI

*COMPUTER COUNTRY
235 Dunn Road
Florissant 63031
314-921-4433

COMPUTERLAND
1214 S. Noland Road
Independence 64055
816-461-6502

COMPUTERLAND
11990 Dorsett Road
Maryland Heights 63043
314-567-3291

*COMPUTER MART
1915 Noland Road
Independence 64055
816-461-5005

COMPUTER VIDEO ROOM
1811 W 43rd
Kansas City 64111
816-531-1050

GATEWAY OFFICE MACHINES
9505 Gravois
Affton 63123
314-631-0110

PARSONS ELECTRONICS
1059 Venture Dr.
St. Charles 63301
314-723-2227

MONTANA

BYTE SHOP
1201 Grand Ave. Suite 3
Billings 59102
406-252-2299

*THE COMPUTER STORE
1216 - 16th St. W. #35
Billings 59102
406-245-0092

NEBRASKA

AMERICAN COMPUTERS
4442 S. 84th
Omaha 68127
402-592-1518

COMPUTERLAND
11031 Elm St.
Omaha 68144
402-391-6716

DOUBLE E ELECTRONICS
280 N. 115th St.
Omaha 68154
402-334-7870

*MIDWEST COMPUTER
8625 "I" Street
Omaha 68127
402-592-3590

NEVADA

BYTE SHOP
4104 S. Keitzke Lane
Reno 89502
702-826-8080

*HOME COMPUTERS
1775 Tropicana
Las Vegas 89109
702-736-6363

INGENUITY, INC.
1562 Linda Way
Sparks 89431
702-359-6671

SUPER SOUND
1727-C E. Charleston
Las Vegas 89104
702-384-1512

NEW HAMPSHIRE

COMPUTERLAND
419 Amherst
Nashua 03060
603-889-5238

L.D. ENTERPRISES
736 Third Ave.
Berlin 03570
603-752-1942

STILLGATE COMPUTER SYSTEMS
1 West St.
Keene 03431
603-357-3981

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COMPUTERLAND
Highway E65, Route 4
Paramus 07652
201-845-9303

COMPUTERLAND
74 Elm St.
Morristown 07960
201-539-4077

COMPUTERLAND
1442 E. Route 70
Cherry Hill 08034
609-795-5900

*THE COMPUTER NOOK
Pinebrook Plaza, Route 46
Pinebrook 07058
201-575-9468

*GARDEN STATE COMPUTERS
922 South Avenue
Westfield 07090
201-232-0511

LURI INDUSTRIES
12 Overlook Road
Rochelle Place 07662
201-843-0020

MEDIA SOFTWARE
372 Highcrest Dr.
West Milford 07480
201-682-3341

MELAD ASSOCIATES
P.O. Box 159
Milltown 08850
201-828-3682

*S.M.I.
600 Washington Ave.
Carlstadt 07072
201-939-4800

*S.S. COMPUTER ENTERPRISES
224 E. Madison Ave.
Cresskill 07626
201-567-8076

STONEHENGE COMPUTER CO.
89 Summit Ave.
Summit 07901
201-277-1020

THOR ELECTRONICS CORP.
321 Pennsylvania Ave.
Linden 07036
201-486-3300

NEW MEXICO

MICROCOMPUTER SERVICES
2201 E. 11th St.
Farmington 84701
505-327-6825

*OMEGA BUSINESS PRODUCTS, INC.
3100 Richmond NE
Albuquerque 87107
505-345-4545

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AMERICAN PERIPHERALS
3 Bangor St.
Lindenhurst 11747
516-587-2615

*A.S.D. OFFICE SYSTEMS
Van Wyck Plaza
Poughkeepsie 12603
914-473-9400

*BC COMMUNICATIONS
207 Depot Road
Huntington Stn. 11746
516-549-8833

THE BINARY ORCHARD, INC.
S-5854 Camp Road
Hamburg 14075
716-648-7167

BITS & BYTES
2800 Straight Rd.
Fredonia 14063
716-673-1682

BITS COMPUTERS
418 W. Dominic St.
Rome 13440
315-336-0266

COMPUCIRCUIT
222 E. Amherst St.
Buffalo 14214
716-838-2442

*THE COMPUTER FACTORY
485 Lexington Ave.
New York City 10017
212-687-5001

*COMPUTER GENERAL STORE
103 Atlantic Ave.
Lynbrook 11563
516-887-1500

*COMPUTER HOUSE, INC.
721 Atlantic Ave.
Rochester 14609
716-654-9238

COMPUTERLAND
1612 Niagara Falls Blvd.
Buffalo 14150
716-836-6511

COMPUTERLAND
79 Westbury Ave.
Carle Place Long Island 11514
516-742-2262

*COMPUTER MICROSYSTEMS
1311 Northern Blvd.
Manhasset 11030
516-627-3640

*COMPUTER SHOP OF SYRACUSE
3470 E. Erie Blvd.
DeWitt 13214
315-446-1284

*COMPUTER STRATEGIES, INC.
300 N. Main St.
Spring Valley 10977
914-356-7770

COMPUTER WORD, INC.
422 Northern Blvd.
Great Neck 11021
516-487-7830

*COMPUTER WORLD
519 Boston Post Rd.
Port Chester 10573
914-937-6662

COMTEK ELECTRONICS
2666 Coney Island
Brooklyn 11235
212-332-5933

EXCEL COMPUTER SERVICES
3636 Hollend Ave.
Bronx 10467
212-652-4028

HONDERS, INC.
Kenil Road
Cuddybackville 12729
914-754-7106

LOGICAL PLAYBACK
10 Grace Ave.
Great Neck 11021
212-624-9075

*MEIZNER BUSINESS MACHINES
24 Lorraine Ave.
Mt. Vernon 10553
914-738-6000

MR COMPUTER
Imperial Plaza
Wappingers Falls 12590
914-297-1223

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127 Madison Ave.
New York City 10016
212-679-5676

*JOHN D. OWENS ASSOC.
12 Schubert Ave.
Staten Island 10305
212-448-6283

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P.O. Box 151
North Tonawanda 14120
716-625-8200

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86 Fair St.
Carmel 10512
914-225-5321

UNITED PHOTOCOPY CO.
41 Union Square
New York City 10003
212-929-4826

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New Hartford 13413
315-733-9139

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218 N. Elm St.
Greensboro 27401
916-275-2983

CAROLINA INFORMATION SYSTEMS
1213 Hillsborough St.
Raleigh 27605
919-833-0210

COMPUTERLAND
3915 E. Independence Blvd.
Charlotte 28205
740-536-8500

CORNER COMPUTER STORE
900 Spring Garden St.
Greensboro 27403
919-272-4867

DATA HELP
P.O. Box 4742
Rocky Mtn. 27801
919-977-5517

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