```
65 LP=S(CM)+L(CM)-1:IF LP>W THEN 200
70 TP=0:FOR R=1 TO RM:FOR C=1 TO CM:READ M
   $
75 P=S(C)-1+TP
80 PRINT TAB(P);M$;:NEXT C
90 IF S(CM)+LEN(M$)-1<W THEN PRINT:GOTO 10
   0:REM WRAPAROUND ADVANCES A LINE
95 IF BR=0 THEN TP=TP+W:IF TP>87 THEN TP=0
   :REM UPDATE TAB IF LINE ENDS W/NO ~
   LF
100 IF BR=0 THEN 120
110 FOR B=1 TO BR:PRINT:NEXT B:REM SKIP BLA
    NK ROWS BETWEEN COLUMN ENTRIES
120 NEXT R
130 GOTO 130:REM DISPLAY ISN'T DISTURBED UN
    TIL USER BREAKS PROGRAM
139 REM ENTER DATA BY ROWS
140 DATA DOCTOR, I,IS,HAVE,COME,SEE,INGEDS
145 DATA TEACHER,YOU,ARE,HAS,BATH,EAT," AOT
    FR"
150 DATA WILL,WE,GO,GOOD,DRINK,AND,.ULHCP
155 DATA HOW,DO,CAN,BAD,SLEEP,IN,?MYWKB
160 DATA WHO,GET,AM,DID,BED,OUT,",VJQZX"
165 DATA WHAT,MOM,WANT,HOT,RADIO,TV,";$%()'
    "
170 DATA WHERE,DAD,TO,COLD,ROOM,YES,"!*/^=:
    "
175 DATA WHEN,HELP,TIME,CALL,FOOD,NO,+56789

200 PRINT "MENU SIZE ERROR!":END
```

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Learning With Computers

Mary M. Humphrey
Teaching Tools: Microcomputer Services

Summer Computing

This fall many teachers will be reading some new answers to an old assignment: "How I Spent My Summer Vacation." They may have already read reports of summer camps with bugs, but this time the bugs are in programs and the correct spelling of bite is b-y-t-e.

A new type of specialty camp, the computer camp, is gaining popularity. Five years ago, the first camp to include computer instruction was started in Connecticut. It was begun with the idea that computing is fun, and children need opportunities to learn about computing as an educational and creative recreation. The idea has spread, and this year there are several computer camps from Cape Cod to San Diego. We can expect their numbers to continue to grow as more children begin using computers in school and at home.

Recently a friend asked his 13 year-old son if he wanted to go to a computer camp this summer. Daniel, who had been working with computers at school and at home, was very excited about the idea. His first question was, "What sports and stuff do they have?" He then wanted to know, "Are there going to be any kids my age?" and, "Who's going to be running it?" It wasn't until the next day that Daniel asked his father, "What computers are they going to have, and what are they going to teach us?" After thinking over the answers for awhile, he asked one last question, "Suppose I don't go to camp this summer, could I have the money to buy my own computer instead?"

The last question was a particularly good one. For kids like Daniel who have had a lot of computing experience, are confident and can get the help they need at school or at home, having their own machine might be a better investment than going to camp. For kids who are just beginning to learn about computers, a computer camp can provide the instruction they need to make good use of their own machine. For kids who are interested in projects beyond their teachers' or parents' skills, a computer camp can be an enjoyable way to get special help. The decision of whether to go to a camp, and to which one, should depend on matching a child's needs and interests to what a camp has to offer.

What To Look For In A Computer Camp

When I began contacting computer camps for information (see Table), I found Daniel's questions quite useful. They cover several important similarities and differences among computer camps:

1) *Camping Activities.* Most computer camps offer a variety of "sports and stuff." Hiking, swimming and field sports are available at all of the camps I contacted, and some also provide tennis, riding, boating, field trips, and indoor sports. Crafts, campfires, and other traditional camping activities are included at all of the overnight camps.

The amount of activities and the time scheduled for them is related to the length of the camping session. Most four week or longer sessions allow a large part of the day for non-computing activities, while one or two week sessions usually provide more intensive computing experiences.

2) *Other Campers.* Some of the camps I contacted accept girls and boys as young as 7 years old, but most camps specify a 10 to 18 year-old age range. All of the camps welcome beginners. The director of a camp starting its third season said that, while as many as half of his campers have no previous computing experience, he also has a number of return students who receive advanced instruction.

In addition to their student instruction, one camp offers a special six week session for teachers on how to teach about computers and programming. During the last three weeks of camp, each teacher works with two of the student campers.

3) *Camp Staff.* Staff can be described as either computing or camping staff, "indoor and outdoor people" as one supervisor termed them. The camping staffs are generally people with experience in leading sports, crafts and group activities. Some camps are managed by professional camping organizations.

The computing staffs vary widely among camps. One camp limits its computer instructors to teachers who have had experience with teaching children about computers. Another camp employs university faculty and students from education and computer science departments. They also bring in special guest speakers from the computer industry. Such staff differences may reflect differing proportions of young beginners and older advanced students at each camp.

4) *Computing Instruction.* All the camps provide instruction in the roles of computers in everyday life and in how computers work. Beginning BASIC programming is also included. Camps with longer sessions usually teach additional topics such as

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Scene from BETA FIGHTER during creation using the DRAWPIC graphics editor.

HODGE PODGE: by Marsha Meredith (Atari and Apple)
NOW AVAILABLE FOR ATARI!!! This captivating program is a marvelous learning device for children from 18 months to 6 years. HODGE PODGE consists of many cartoons, animation and songs which appear when any key on the computer is depressed. A must for any family containing young children.
PRICE .... **$19.95** diskette

☐ **PM EDITOR:** by Dennis Zander (Atari, 16K)
Create your own fast action graphics game for the Atari 400 or 800 using its player missile graphics features. By using player data stored as strings, players can be moved or changed (for animation) at machine language speed. All this is done with string variables (PO$(Y)=SHIP4) This program is designed to permit creation of up to 4 players on the screen, store them as string data and then immediately try them out in the demo game included in the program. Instructions for use in your own game are included. PM EDITOR was used to create the animated characters in **ARTWORX** RINGS OF THE EMPIRE and ENCOUNTER AT QUESTAR IV.
PRICE .... **$29.95** cassette **$33.95** diskette

☐ **ROCKET RAIDERS** by Richard Petersen (Atari 24K)
Defend your asteroid base against pulsar bombs, rockets, lasers, and the dreaded "stealth saucer" as aliens attempt to penetrate your protective force field. Precise target sighting allows you to fire at the enemy using magnetic impulse missiles to help protect your colony and its vital structures.
PRICE .... **$19.95** cassette **$23.95** diskette

☐ **FOREST FIRE TWO:** by Richard Petersen (Atari 24K)
FOREST FIRE has been enhanced and now offers a two player mode for head to head competition to see who can survive, suffer the least damage and put their fire out first. User input now determines landscape, wind and weather conditions, offering limitless game variation. FOREST FIRE's excellent color graphics have been made even better, turning your computer into a super-detailed fire scanner.
PRICE .... $16.95 cassette $20.95 diskette

☐ **GIANT SLALOM:** by Dennis Zander (Atari, 16K)
Bring the Winter Olympics to your computer anytime of the year! Use the joystick to guide your skier's path down a giant slalom course consisting of open and closed gates. Choose from three levels of difficulty. Take practice runs or compete against from two to eight additional skiers.
PRICE .... **$15.95** cassette **$19.95** diskette

☐ **THE PREDICTOR** by Thomas Barker
(Apple, Atari, TRS-80, North Star and CP/M (M-BASIC)
This is a complete package that covers least squares fitting of parameters for two or more variables. THE PREDICTOR can be used for predicting sales and process behavior, trend analysis, model building and many other uses calling for multilinear regression techniques. Each option in the program is prompted with simple YES/NO commands making it **very** easy to use.
PRICE .... **$29.95** diskette

☐ **PILOT:** by Michael Piro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. PILOT produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE .... **$16.95** cassette **$20.95** diskette

☐ **TEACHER'S PET:** by Arthur Walsh (Atari, Apple, TRS-80, PET, North Star and CP/M (MBASIC) systems).
This is an introduction to computers as well as a learning tool for the young computerist (ages 3-7). The program provides counting practice, letter-word recognition and three levels of math skills.
PRICE .... **$14.95** cassette **$18.95** diskette

☐ **MAIL LIST 3.0:** (Atari, Apple and North Star)
The very popular MAIL LIST 2.2 has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. MAIL LIST is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and MAIL LIST will even find and delete duplicate entries! The address files created with MAIL LIST are completely compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE .... **$49.95** diskette

☐ **THE VAULTS OF ZURICH:** by Felix and Greg Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: THE OPEC OIL DEEDS!
PRICE .... **$21.95** cassette **$25.95** diskette

☐ **BRIDGE 2.0** by Arthur Walsh (Atari (24K), Apple TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, BRIDGE 2.0 is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE .... **$17.95** cassette **$21.95** diskette

☐ **ENCOUNTER AT QUESTAR IV:** by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend Questar Sector IV from the dreaded Zentarians. Using your plasma beam, hyperspace engines and wits to avoid Zentarian mines and death phasers, you struggle to stay alive. This BASIC/Assembly level program has super sound, full player missile graphics and real time action.
PRICE .... **$21.95** cassette **$25.95** diskette

NEW PROGRAMS!

HAZARD RUN: by Dennis Zander (Atari, 16K)
The sheriff has spotted you and you must make the treacherous run through Crooked Canyon past Bryan's Pond to the jump at Hazard Creek and safety. You can even put the joystick-controlled GEE LEE car up on two wheels to make it through some tight spots. A lead foot is not always the answer as you dodge trees, rocks and chickens in this nerve-racking game. HAZARD RUN employs full use of player/missile graphics, re-defined characters and fine scrolling techniques to provide loads of fast action and visual excitement.
PRICE .... **$27.95** cassette **$31.95** diskette

BETA FIGHTER: by Douglas McFarland (Atari, 16K)
See who will be the ace gunner in this action game set on a spectacular Martian landscape. BETA FIGHTER can be played with one or two players and uses player/missile graphics and delightful sound effects.
PRICE .... **$16.95** cassette **$20.95** diskette

DRAWPIC: by Dennis Zander (Atari 16K)
DRAWPIC provides the user with an unbelievably easy way to create screens in graphics modes 3-7. Just sit back with your joystick and use POINT PLOT, DRAW LINE, RUBBER BAND fill and COLOR SET to create beautiful images on your Atari. Full or partial screen images are saved as string data in the program and can be instantly recalled and combined into new images using machine language subroutines. These graphic images can be easily incorporated into your own programs. The images of HODGE PODGE and the landscape of BETA FIGHTER were made using DRAWPIC.
PRICE .... **$29.95** cassette **$33.95** diskette

T: A TEXT DISPLAY DEVICE: by Joseph Wrobel (Atari 16K)
T: is an auto-loading, co-resident assembly language routine which greatly expands the display capabilities of the Atari. It allows you to freely intermix both text and graphics without the use of modified display lists, PEEKS or POKES. This is done by defining a new device ("T:"); printing to that device puts text onto the screen. The size of the text is determined by the graphics mode used.
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COMPUTER CAMPS

Camp Organization	Camp Location(s)	Sessions / Prices	Campers	Computer Instruction	Computer Resources
Atari Computer Camp 40 East 34th St. New York, NY 10016 (800)847-4180	U.C. San Diego Asheville, NC Sheboygan, WI E. Stroudsburg, PA	4 weeks/ $1590 8 weeks/ $2790 ($100 deposit)	10-18 years old	2 hours instruction and all day free time "Designing our own computer curriculum"	Atari 400 & 800 2 kids: 1 computer
Computer Camp, Inc. Suite G 1235 Coast Valley Santa Barbara, CA 93108 (800)235-6965	Santa Barbara, CA Tahoe Pines, CA Cape Cod, MA	2 weeks/ $795	7-16 (80 per session)	3 hours instruction 3 hour's free time "BASIC, PASCAL, FORTRAN, assembler, electronics lab, AI, robotics"	Apple, Atari Commodore, Texas Instruments 2:1
Computers for Kids, Inc. 8 Benton Ct. #4 Tiburon, CA 94920 (415)435-1310	Tiburon, CA	1 & 2 weeks approx. $4-500. per week	10-18 (30-35 per session)	2-3 hours instruction "computer literacy. BASIC, special projects"	Apple, IBM personal computer 25 computers
Computer Tutors at Stanford School of Ed. Stanford University Stanford, CA 94306 (415)497-2119	Stanford University	5 weeks (days) $1000 (extra fee for resident camp)	12-15 (66 per session)	3 hours instruction afternoon free time "BASIC, assembler, PASCAL, graphics, video disks, word processing, robotics"	IBM personal computers 2:1
Data Base Computer Camp 6454 Valley View Rd. Oakland, CA 94611 (415)339-2961	Placerville, CA	10 days/ $425 ($150 deposit)	7-16 (50 per session)	3 hours instruction and free time "computer literacy, BASIC, special projects"	Apple, Commodore 2:1
National Computer Camp Box 624 Orange, CT 06477 (203)795-3049	Orange, CT Atlanta, GA	1,2,& 4 weeks $345 per week	10-18 (120 per session)	2-3 hours instruction all day free time "BASIC, machine & assembler, novice to advanced instruction"	TRS-80, Apple, Commodore, Wang 50 computers
Timberline Tech Computer Camp 1287 Lawrence Sta. Rd. Sunnyvale, CA 94086 (408)745-1110	Sunnyvale, CA	2 weeks/ approx. $895	10-17 (60 per session)	2-3 hours instruction and free time "beginning to advanced instruction"	Apple 2:1
Computer Camps International 310 Hartford Turnpike Vernon, CT 06066 (203)871-9227	East Haddam, CT Denton, TX Whitewater, WI ("many East coast sites")	2 weeks/ $290 (1/2 day sessions) /$795	5-17(day) 9-17(res) (100 per session)	4 hours instruction and free time "any level-BASIC, LOGO, other languages, robotics, special projects – computer morality class"	Apple, Texas Instruments 100 computers 1:1
CompuCamp 7101 York Ave. South Edina, MN 55435 (612)835-0064	St. Paul, MN Beaver Falls, PA	1 & 2 weeks $175/wk-day camp $390/week residence camp	8-17 (50-75 per session)	5 hours instruction and free time "BASIC, LOGO, PASCAL, PLATO* Tutor, beginning to advanced instruction	Apple, Atari, Texas Instruments, TRS-80, PLATO Tutor System* 2:1
Lake Forest Computer Camp Sheridan & College Roads Lake Forest, IL 60045 (312)234-3100	Lake Forest College, IL	1 week/ $350	11-17 (70 per session)	6 hours instruction 3 hours free time "beginning and intermediate BASIC"	Apple 2:1

*PLATO: Control Data Corporation microcomputer specially developed for PLATO software.

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other computer languages, use of peripheral devices like printers and video discs, graphics, word processing, robotics and special projects. Some camps also provide an electronics lab as one type of "crafts" class.

Many camps have more than one type of microcomputer system available. Campers usually work two to a machine – the buddy system appears to be a good idea for computing as well as other camp activities. Generally, there is one instructor for every three to five campers. Classes last two to three hours each day. All of the camps provide free time for extra computer practice. Some camps do restrict game playing to the lowest priority for computer use, or to using only games made by the campers themselves.

The Table gives a sampling of the computer camps available this summer. It includes addresses and phone numbers to contact for more information.

What If You're Not Going To Camp?

The summer months mean kids are out of school, families take vacations, and there is generally more time for parents and kids to do things together. Home computing is one activity you can enjoy as a family recreation.

The most obvious choices for recreational home computing are game programs. These should be chosen with some consideration to who will be playing them, as well as what the game does. Games that require quick reflexes and good visual-motor coordination provide exciting competition for players of about the same skill level. However, when there is a great difference in ability, some parents may be disappointed to learn that they are no competition for their children. Competitive games that stress strategies or knowledge of particular facts are also best used by players of about the same level. While parents can use this type of game to teach their children, it may not be very interesting for the parent, and more like homework than a game for the child.

Adventure games are one type of computing activity that works well with parents and children. The game presents a challenging task, such as finding a treasure or getting to a secret place before a certain time limit. Players are given messages and hints to help find their way, avoid dangers and enemies, and gather extra treasures or points. The adventures are designed to allow players many options and to respond differently to each choice. Since players work together to accomplish the task, rather than working against each other, different ability levels don't lead to lopsided scores. The details of each game change as players make different choices of what to do and where to go. This kind of variety within a set of rules means players get better with practice, but not bored. Adventure games encourage a lot of discussion and decisions among players and are a good choice for family computing.

Creating your own household software can be an effective and enjoyable way to learn programming skills and coordinate computing with other family activities. Parents and kids can work together on writing small programs to compute the gas mileage of the family car, keep track of vacation expenses, figure batting averages for a whole little league team, print out price labels for a garage sale, etc... Maybe you can use VisiCalc or other commercial programs to do all of these tasks, but then you wouldn't have the fun and learning that come from working together on a very personalized project.

Programs for composing and playing music and for creating graphic art displays share features with the activities recommended above: they are fun and easy to use, allow people with different skill levels to work together, encourage interaction between the users, and have enough variety to be used many times. With a little imagination, parents and kids can come up with many more ideas for fun home computing.

Next month's column will cover another topic of interest to kids, parents, and teachers who learn with computers – LOGO, a computer language designed for children and computer novices. Three versions of the LOGO language, Apple LOGO by LOGO Computer Systems, Inc., the Terrapin LOGO Language by Terrapin, Inc., and M.I.T. LOGO by Krell Software Corp. will be reviewed. ©

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Review:

VIC-20 Cartridge Games

Harvey B. Herman
Associate Editor

The cartridge games described here have some common features. They all plug in to the back of the VIC and start automatically on power up. Each has impressive graphics, color, and sound as part of the program. They begin with a demonstration of the program features. Provision is made to center the program on the screen if your TV is misaligned. Many of the games can be played with either the keyboard or a joystick. When a score is shown, the previous high is also given, so subsequent players have something to shoot for.

One cautionary note: do not insert or remove the cartridge with power on. The instructions make this point and I heartily endorse it. Perhaps it would be wise to assign the task to a careful adult or older child. Now on to the games.

Jupiter Lander

Armchair astronauts can now have a real time simulation of a space ship landing on Jupiter. Three landing sites are available – two of them are quite difficult at first. Your object is to score the most points before your fuel runs out. When you land softly, bonus points are awarded and your fuel supply is boosted. More difficult sites, of course, have a higher bonus. The rate of descent (or ascent) is continuously monitored by a gauge on the right side of the screen. The landing is A-OK if the gauge needle is centered on touchdown.

My kids rated the game, initially, 8 out of 10. However, they seem to play it more than the others so I suspect the real rating is higher. An old fogey, like me, enjoyed it, but found it almost impossible to land on the more difficult sites. The kids found it challenging but learned how to do it almost every time. C'est la vie.

Super Alien

You are in an irregular grid being chased by unfriendly aliens trying desperately to stay alive. When an alien catches you, he eats you – not a pretty sight. The object is to score points by trapping them in air bubbles which you have laid down in strategic spots. When an alien is trapped by a fully inflated air bubble, you have a short time to reach it (using the keyboard or joystick) and deflate it off the board. Otherwise, the alien escapes, destroys the bubble and continues the chase. Points are scored when an alien is removed from the board. The number of points is determined by removal time, i.e., faster players will receive a higher score. Extra aliens are added when all the aliens are removed and the game begins anew. Your turn is over when you have been eaten three times. The aliens are normally relatively slow moving and not terribly smart. However, if the game goes on too long, they suddenly become fast and aggressive and it is impossible to escape their greedy mouths.

I enjoyed playing this game more than my kids; they rated it 6 out of 10. Perhaps they were influenced by the fact that our joystick was not working properly (the connector was loose) and they were forced to use the keyboard. Also the grid was oversized for our TV and you could not see the score and the whole grid at the same time.

VIC Avenger

This program is modeled after the popular arcade game, Space Invaders. You are in control of a base (space ship) at the bottom of the screen which can move left or right while firing at enemy aliens and dodging their bombs. The aliens are arranged in rows which move back and forth relentlessly closing in with time. As with many of the other games, you are given a choice of keyboard or joystick control. Points are scored when you destroy an alien. At unpredictable times a mystery ship moves across the screen. Each class of alien is assigned a different point value. The score for the mystery ship is random. Your base can protect itself by hiding behind solid objects but these are continuously being annihilated by enemy bombs. If the aliens drop too low you cannot avoid being destroyed.

At the start you are given three bases (turns). When you reach 1500 points an extra base is awarded. The game is over when you have lost all your bases. My kids rated it 9 out of 10 and it has proven to be the second most popular game. They have become quite proficient at it and put my feeble attempts to shame.

Draw Poker

VIC deals you a poker hand and your payoff is determined by the odds. Less than a pair of jacks is worthless but a big hand like a royal flush pays 500 to 1. You are allowed to bet up to 9 coins. As you bet, odds are displayed so you can see exactly how much each poker hand is worth. The cards have their backs to you (Commodore Japan logo) and are exposed dramatically one at a time. After the

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Software package includes the program tape with 2 programs, transducer, and hardware to attach to any standard 24 to 27-inch frame bicycle. Optional professional style bike stand with integral wind load simulator is also available.

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deal and before the draw you select the cards you want to keep (0 to 5). If you wind up with a winning hand the bank will offer to cut cards with you, double or nothing. Resist the temptation on big winning hands.

My kids rated it 6 out of 10 as they don't seem to care much for poker simulations. As for me, I prefer losing to friends.

Super Slot

This program is a realistic computer simulation of a slot machine. I believe you lose as fast as you do on the real ones in Las Vegas or Atlantic City. You have the option of playing with the keyboard or a joystick. First you place a bet of up to 5 coins from your initial stake of 80. Betting extra coins allows more winning combinations. If you bet the maximum, you can win five different ways. The possible winning combinations are shown initially and can be recalled at will. When you're ready to play, a smiling man is shown pulling a lever. He keeps smiling even when you lose. The wheels spin – cherries, lemons, plums and other assorted goodies flash in front of you. The three wheels stop one at a time with lots of dramatic music. If a win shows, your money supply goes up. In any case it's time to bet again. As in real life, the game is over when your money is gone.

The kids and I were impressed with the remarkable graphic symbols. They rated it 9 out of 10. I am not sure how long it can keep an adult who isn't an inveterate gambler amused. Nevertheless, the program should be seen just to appreciate the capabilities of the VIC.

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We'll have a review of two implementations of FORTH for PET and one for Apple and other Atari FORTHs in upcoming issues. For further information about this increasingly popular language, see The Forth Page elsewhere in this issue.

Review:

QS FORTH For Atari

Charles Brannon
Editorial Assistant

FORTH is now available for almost any computer, thanks to the distribution of public domain source code for the language by the FORTH Interest Group (FIG). Fig-FORTH is the group's implementation standard of FORTH for microcomputers.

QS FORTH was the first Atari implementation of fig-FORTH. It comes on a floppy disk with a padded vinyl manual. The manual is extensive and well-written, but does assume a basic familiarity with FORTH. An excellent resource for learning to program in FORTH is *Starting FORTH* by Leo Brodie (available from the FORTH Interest Group, P.O. Box 1105, San Carlos, CA 94070, $16.00).

The QS manual is divided into chapters devoted to various classifications of FORTH words (such as INPUT/OUTPUT, number-handling, compiler words, etc.). In the back of the book are some useful sample programs and an extensive FORTH glossary (vital to the FORTH programmer), with a solid explanation of every FORTH word in the vocabulary.

The Editor

An important consideration of a FORTH system is the Editor, since you'll be using it to prepare your program for saving onto disk (although you can also compile FORTH words "interactively"). The QS FORTH Editor is very well done. It is a page-oriented text editor which permits you to type your program in as if you were using a word processor. You can edit programs as large as the disk can hold, by paging forward and backward through your screens at the touch of a single key. One disadvantage is that QS FORTH screens are only half as large as standard fig-FORTH screens, (sixteen 32-character lines rather than 64 character lines).

This ease of editing lasts only while in the Edit mode, however. When in direct mode, you cannot move the cursor around the screen and edit, as you can in BASIC or with the Assembler Cartridge. You cannot clear the screen without invoking an error message.

Features

QS FORTH supports the full fig-FORTH vocabulary, so let's look at the "extras" available. QS FORTH offers a utility package that adds several useful programming tools, such as a simple CASE structure, memory DUMP, Stack Print (shows contents of a stack non-destructively), 2DUP (double DUP), and LOCATE, a handy word that will list the source screen of a word, if it was compiled from disk. Also included is an I/O package that supports printer, cassette, screen, and keyboard input/output, using an approach similar to BASIC with OPEN, PUT/GET, and CLOSE. There is also a printer toggle that can switch output to the printer or screen. Included in the I/O package is a set of words to access Atari graphics. The similarity to BASIC continues here as well with words like GRAPHICS, SETCOLOR, PLOT, DRAWTO, etc. Use of the Atari's four-voice sound is also supported, with SOUND and XSND. XSND is a useful word that shuts off all sound, a task usually accomplished with END in BASIC.

The Assembler

QS FORTH includes a powerful assembler. Like most FORTH assemblers, the code for the assembler is remarkably brief, yet it supports source code with labels, structured control statements such as IF/ENDIF and BEGIN/UNTIL, and multiple statements per line. This assembler lacks many 6502 FORTH assembler standards such as N, IP, W, and only supports one macro return – PUSHOA. Nevertheless, it is quite useable.

Disk I/O

QS FORTH, again like most FORTHs, does not use the standard Atari DOS. It simply formats the disk into screens, and accesses this data directly, rather than indirectly, via DOS. This makes more disk memory available, and simplifies I/O, but it creates a compatibility problem. FORTH cannot read files produced by BASIC or even machine language. Despite this, QS FORTH expects new disks to be formatted by DOS II. There are also words to COPY screens or duplicate the entire disk using a sector-by-sector copier.

FORTH is coming into its own as a language. In the latest APX catalog, for example, two very impressive programs were in FORTH.

QS FORTH
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Review:

Hardbox For PET/CBM

Richard Mansfield
Assistant Editor

The old distinctions between "big" and "small," between mini- and microcomputers, keep breaking down. What would you call a PET with 80 megabytes (80 million bytes) of memory? It is possible to attach as many as four Corvus hard disk units with up to 20 megabytes each to a PET by using Small Systems Engineering's new Hardbox.

A typical setup would involve attaching the cable (which normally goes between your computer and a floppy disk drive) to the Hardbox instead. The unit is about as big as a medium-sized portable radio and connects directly to a Corvus hard disk drive. It acts as an intelligent controller and can handle up to four hard drives – hence, 80 megabytes.

It takes very little getting used to: the software is compatible with both PET/CBM DOS versions one and two so it will work with floppy files and existing programs. The manufacturer states that it "is designed to appear to the PET as a fast, high-capacity floppy disk unit" and that's what it does. Even the "wedge" is allowed. To scratch a file, for example, you could use either sC"name" or PRINT#1,"S0:filename" – the two, familiar DOS grammars. The Hardbox comes with a collection of utility programs for diagnostics, formatting, backup, and so on. The only unsupported DOS commands are memory-read, -write, and execute.

Data transfer is fast. Drive access time for ten or 20 megabyte drives is 40ms average and a five megabyte drive is 125ms average. The maximum record size is 255 bytes in relative files, the maximum number of records is 65535, and the maximum file size is 16 megabytes, either sequential or relative. On a five megabyte drive, more than 2000 files can be created with 13 open per Hardbox at any one time.

There is an issue to be resolved when using megabyte hard disks. How do you back them up? A 20 megabyte Corvus unit costs $5995. It may be impractical to buy a second unit to serve merely as backup. The solution? "Corvus Mirror" is supported by the Hardbox. An ordinary videocassette recorder can be attached as a backup device and it will copy the hard disk at a rate of 7.5K per second. A ten megabyte drive can be backed up in 20 minutes. Alternatively, a PET floppy drive or even a cassette unit could be used for backing up medium-size files.

Hardbox also supports multi-user environments. With an eight-way multiplexer, eight PETs can address the same hard disk at the same time, with individual and shared areas, passwords, and protected zones. Each Hardbox may be separated by up to 20 yards from the multiplexer and, with two levels of multiplexing, a maximum of 64 users can connect.

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Book Review:

Beyond Games:

Systems Software For Your 6502 Personal Computer

Jim Butterfield
Toronto

This book covers 6502 machine language essentials for four machines: Apple, Atari, Ohio Scientific and PET. It does this by building a monitor, piece by piece; differences between machines are accomodated by a "system data block" which covers such things as the length of a screen line, input/output routines, etc.

The Approach

The author spends four chapters outlining the characteristics of the 6502 in a fairly easy and pictorial manner; it's not a rigorous treatment, but users will find it non-intimidating. In chapter five he begins writing some "useful" subroutines, making allowances for the differences between the various machines.

Starting at chapter six, we have an objective: let's write a "visible monitor" which will do many of the things a monitor system does: displaying registers and memory and allowing changes. The monitor builds on the subroutines previously established.

The initial monitor looks rather like that of the KIM; it allows only one memory location to be displayed or changed, plus various registers. Subsequent chapters add features to the monitor, giving such facilities as hexadecimal dumps, disassemblies, other utilities and a simple text editor.

Appendices give the various program modules in Assembler Code, Hexadecimal dump format, and BASIC DATA statements (for POKEing). Oddly, the "system data block" is not supplied in hexadecimal.

The Monitor

Readers should accept the "visible monitor" as an exercise, not as a powerful working tool that they will depend upon in the future. Some essential features are missing, especially interfaces to external code: breakpoints and GO. The monitor takes up a lot of room – 4K of memory – in view of what you get. Most machines will have good monitors already in place.

But the monitor itself isn't the object of the game. Getting there is most of the fun, or at least the education, and users should seek to do more than just type in coding lines: they should try to understand the objectives and methodology.

Some routines are written, but not used im-

Perhaps the single most useful part of the book is the way that it compares the various 6502 machines.

mediately. At the end of chapter 7, there are two exercises to try to overcome this problem; it would have been useful to have many more of these to aid checkout of the various modules. If the user is going to write a routine, he's better off if he can put it to use right away.

There are some operational features of the visible monitor that could be streamlined. The prompt which asks the user to supply an address should flip him into the address mode to guard against errors, for example. Some of the missing features might be considered "student exercises"; the reader should be able to improve on things he doesn't like.

The monitor doesn't deal with input/output other than the keyboard and screen. The logic makes room for a printer, but the coding to make the connection isn't in place. Activities are confined to the screen.

Perhaps the book's title is misleading in at least this sense. A prospective buyer would be likely to think: "Beyond Games? Must be business applications." If so, he might be disappointed to find a book that is concerned with inner space – memory manipulation and hexadecimal notation rather than business-oriented techniques.

The Material

The book's approach to learning coding is very matter-of-fact. Theory is not stressed and the material is presented pleasantly in a conversational manner.

There are a few errors; generally, they are minor in nature. In a discussion of indexing, page 21, it is stated that "...the 6502 will operate on some address higher (...or equal to the base address...) in memory." That's not always true for zero page indexing.

The author has quite a bit of trouble with the Compare instruction and the associated flags. Page

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23 incorrectly shows the condition of the N flag after a compare (it might be easier to mark this flag "not relevant"), and a footnote on the same page states: If you wish to test the status of the Carry flag after a Compare, you must set it before the compare. Wrong. The sample coding carries through the error in part: page 55 gives the sequence CMP #$0A; BMI ... which is bad logic (it should be BCC) but does work in this case since the range of numbers in A is limited. Elsewhere, this type of sequence is given correctly – address 13DA has satisfactory code – did the author learn as he wrote the book?

The output of the disassembler is not satisfying. Indirect indexed addressing should show the addresses in zero page mode. The use of the dollar sign to signify hexadecimal is not consistent within the disassembly. Unidentified op codes are translated as BAD, which I tend to read as Binary Add; and one byte is almost inexplicably translated to TEX.

The hex dumps are hard to read. I had repeated problems distinguishing the digit 8 from 9 or B. The dump labeled D3 has an incorrect byte at $13D2; at least, it's incorrect until you plug in the exercise given much later in D11.

The book is nicely written and the program listings well commented. The visible monitor itself is probably not a useful end product, but the learning process along the way can be very valuable.

Perhaps the single most useful part of the book is the way that it compares the various 6502 machines. Several appendices compare the character sets, screen mapping, and simple input/output characteristics of the various machines. Even if a reader knows machine language, he may find value here. The broader characteristics of the machine (other I/O such as disk and printer) is not dealt with in any depth.

I hate the title: it's not relevant. "Beyond BASIC" might have made more sense, since the objective is to teach machine language techniques. After all, games – very good games – can be written in machine language; and monitors can be written in BASIC.

In many ways, it's a pleasing book. It's one of the few that attempts to teach you 6502 machine language with reference to the actual machine in which the language will reside.

Beyond Games: Systems Software for Your 6502 Personal Computer
by Ken Skier
BYTE/McGraw Hill
70 Main Street, Peterborough, NH 03458
432 pages. $14.95

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Book Review:

6502 Assembly Language Routines

Jim Butterfield
Toronto

Here's a book containing over 40 subroutines to do some of the most common jobs in 6502 Assembly language.

The subroutines correspond to some of a programmer's most commonly needed tasks. Input, output, arrays, arithemetic and string functions are dealt with. The end result is a handy recipe book of frequently needed operations.

The emphasis is on utility functions. Complete packaged programs are not offered here; the reader is supplied with the coding chunks he needs for the bread and butter activities. Want to input a decimal number in ASCII and convert it to binary? You'll find the information here. The same is true if you want to output, to use hexadecimal numbers, or convert to the EBCDIC character set.

Organization

The first 160 pages or so might be termed, "A 6502 review manual." The characteristics of the 6502 are reviewed in the first chapter, entitled General Programming Methods. The second chapter seems directed to users from other processor environments: it shows how to implement features they might view as "missing" from the 6502's instruction set. For example, how do you negate the value in the A register? Exclusive OR with hexadecimal FF and then add 1, that's how. Users without experience from other environments will still find this a fascinating collection of simple techniques.

Chapter 3 is a beauty. Entitled "Common Programming Errors," it itemizes in detail some of the most frequent mistakes that 6502 programmers make. It's valuable reading. Indeed, perhaps the authors should have read it themselves one last time: they might have spotted their minor coding error on page 182, where they use BPL after a comparison. As page 136 sternly points out, "In comparing unsigned numbers, the Carry flag indicates which number is larger."

The program section starts on page 157. At this point, there are details on how the subroutines are organized. There's also a list of the subroutines themselves, which might have more properly been given in or near the Table of Contents at the start of the book.

The programs are broken into categories: Code conversion, Array Manipulation, Arithmetic, Bit Manipulation, String Manipulation, Array Operations, Input/Output and Interrupts. The book concludes with three appendixes containing general reference material, a Glossary, and an Index.

Program Style

It should be emphasized that the programs are supplied in assembly language, not machine language. The reader will not see the final machine code; he's expected to take the "source coding" and put it through his own assembly process. Similarly, the user will choose the location of the program and its variables when he performs the assembly. This gives the book's programs a rather abstract feel even though they can be assembled into working code very quickly.

The assembly language is non-standard for the 6502 environment. Where most coders would write hexadecimal FF as $FF, the book writes 0FFH. Where the standard assembler code to set aside two locations should be *=*+2, the book uses .BLOCK 2. This seems to be an offshoot of Adam Osborne's determination to hew to a universal assembly language standard. Unfortunately, there doesn't seem to be a 6502 assembler using such a standard; as a result, the book becomes a little more difficult to read and use.

Each subroutine comes with excellent formalized documentation. Memory space used, execution time and many other relevant factors are carefully noted. There is a variety of styles, particularly in the area of passing values to and from the subroutine: sometimes it's a common area, sometimes the registers, sometimes the stack. The knowledgeable reader should have no trouble adapting this to the particular style wanted. It's all well spelled out.

The coding is straightforward and non-clever. You won't find any elegant and obscure algorithms in this collection; and that's probably good. If you decide to try your hand at adapting a program to your own special requirements, it will be unlikely to jump up and bite you. The code takes the obvious approaches; and this is particularly good for learning.

Sometimes the authors err on the side of caution. In Multiple-Precision Binary Addition and Subtraction, for example, they specify that the routines add and subtract unsigned binary

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numbers. In fact, the same routines work on signed numbers.

Coverage

The emphasis is on integer arithmetic. Reasonable enough considering that the vast majority of machine language applications are integer-oriented. Some readers might wish for information on floating-point or even fixed-point fractions; they won't find it here.

Arithmetic is limited to the four basic functions. This is to be expected where numbers are fixed point. Don't look for square root routines or more advanced material here ... it's all fundamentals.

Many of the arithmetic routines assume that all values have the same size (same number of bytes). This may need to be adjusted by the user: for example, it is often useful in division to have a small divisor (or quotient).

Strings are "conventional," limited to a maximum of 255 bytes. Users may find it necessary to shift the coding around to suit their own particular organization. The book assumes that string length is supplied as a value. Other systems – signalling the end of a string with a zero byte or a carriage return – would need some minor adjustments.

The only sort given is a bubble sort. That has the advantage of simplicity, but perhaps readers should be warned that it's rather inefficient and they should keep their eyes open for other, more efficient, techniques.

The RAM Test program is naive. The most common RAM failure is not caused by storing information and not being able to read it back. It's a result of interference between addresses: store something at one address and it will also appear in another location. You'll never catch this kind of thing by storing and checking a single byte at a time.

I missed random numbers. There are several easy techniques, and at least one might have been usefully supplied.

It's a highly useful reference book. The introduction is a good summary of the 6502's working characteristics; the programs are useful ones that can be put to work.

The book is especially well adapted to a user who is moving to the 6502 from other processors. Complete beginners might find that the book is too fast for them, but the information is all there.

6502 Assembly Language Subroutines
by Lance A. Leventhal and Winthrop Saville
Osborne/McGraw Hill, 630 Bancroft Way
Berkeley, CA 94710
550 pages. $16.99

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COMPUTE! *will be covering FORTH regularly. FORTH is sometimes mentioned as an alternative to machine language: it is easier to program than machine language and it runs faster than BASIC. However, machine language itself can be easily woven into a FORTH program when greater speeds are necessary.*

The FORTH Page

Machine Language And FORTH

Richard Mansfield
Assistant Editor

What language you decide to use is frequently a question of speed: how fast you can program with it or how fast the program itself will later execute. One of the advantages of FORTH is that most people find they can program in it faster than in machine language. And FORTH executes at roughly 20 times the speed of a comparable BASIC program.

Machine language runs at maximum machine speed. There is no "interpreting" going on during execution, events tumble past one another. Nothing has to be translated; machine language *is* the machine's native language. Things do not so much *mean* something in machine language – they *are* that something. The drawback is that the programmer must spend extra time (sometimes a great deal of extra time) writing the program itself.

FORTH is a curious language, however, from several points of view. Some programmers take to it immediately and fiercely, never returning to BASIC. They find FORTH the most natural, most efficient way to communicate with their computer and they can program faster in FORTH than in BASIC.

Others find FORTH difficult, bizarre even. FOR I = 1 TO 10 becomes 11 1 DO in FORTH. There are three to four times as many statements and commands (called *words*) in FORTH as there in the BASIC vocabulary. So choices are multiplied: there can be dozens of ways to get there from here.

Many versions of FORTH include an assembler. Like programming in FORTH itself, FORTH assembling can have a remarkable clarity and simplicity – once you're accustomed to the oddities.

If a FORTH program is executing too slowly, you can look for the loop where the most frequently repeated action is going on. Replacing key parts of this loop with machine language can greatly speed up the program run.

... FORTH assembling can have a remarkable clarity and simplicity – once you're accustomed to the oddities.

An Example Of FORTH Code

Take a look at Screen 100 (Program 1). This is an example of a machine language subroutine within a FORTH routine. The small program called TEST is expected to search through any screen, looking at each byte for whatever character has previously been stored in the variable 1STCHAR. It prints the addresses of any matches.

To execute TEST, you would type 10 BLOCK TEST to find all matches, on screen ten for example. Above TEST is the machine language word ?CHAR which is used by TEST to make each comparison. This might seem a roundabout way of doing things, but it does result in roughly triple the speed of a comparable subroutine for ?CHAR written in straight FORTH.

Where an ordinary FORTH word begins with a colon (:), machine language is invoked with the word *CODE* which changes the number base to hexadecimal and sets up the assembler. Program 2 is a disassembly of ?CHAR. It is useful, especially when first working with FORTH assembly, to be able to easily disassemble and study the code you create. Notice that 1 # LDA, is the traditional LDA #$01. FORTH, as always, expects reverse notation; in assembling, the format is operand-addressing mode-mnemonic.

SETUP JSR, sends the machine to a subroutine which eases communication between FORTH and machine language. SETUP transfers bytes from the FORTH stack to a temporary, eight-byte holding area, called *N*, which starts at address $10 (on the PET). It will move items in two-byte chunks since FORTH operates on two bytes at a time. It knows how much to move by looking at the accumulator. We put a one into the accumulator, so it moves a

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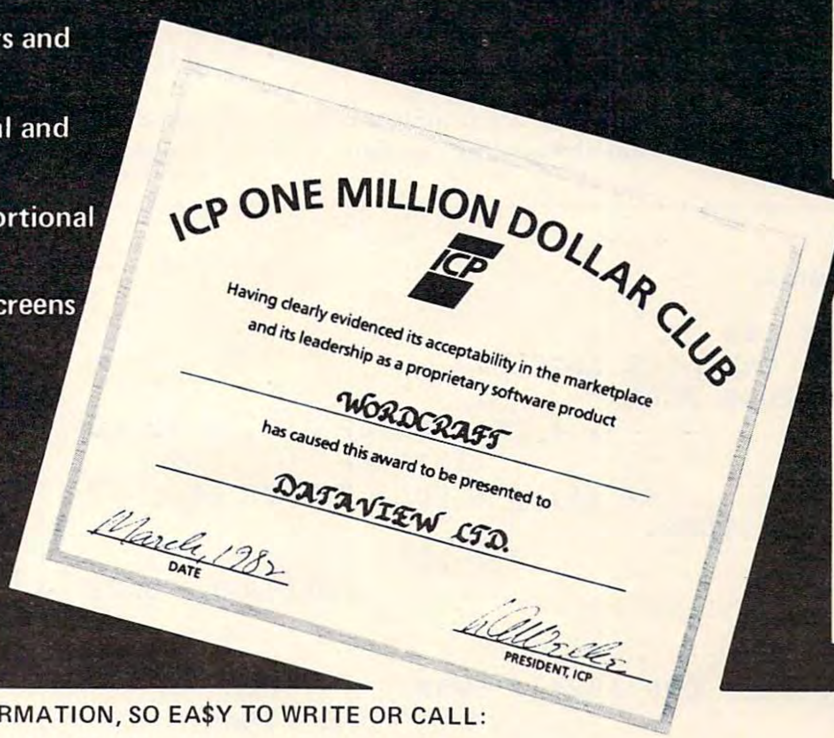

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two-byte unit off the FORTH stack (this is the I, the address within a screen to be checked, generated by the loop in TEST). If we'd used 02 # LDA, four bytes would have been transferred from the stack to N.

Following SETUP, the address of the target byte is at N (properly in low-high 6502 addressing format), so we can load the accumulator with indirect Y to fetch the byte from memory. Two points: when you descend to machine language from FORTH, the Y register is set to zero – you need not LDY #$00. Also, the X register is used by FORTH as the pointer to its stack. If your machine language subroutine will in any way affect X, you should XSAVE STX, before anything else and XSAVE LDX, before returning to FORTH. XSAVE, like N, is a temporary holding space which is a safe place to keep the X register.

Line three illustrates another way that machine language easily communicates with FORTH. The variable 1STCHAR might contain a decimal 76 (ASCII code for the letter *L*.) This would allow TEST to find all the L's on screen 100 if we later typed 100 BLOCK TEST. To get this 76 which is in 1STCHAR into the machine language code, we need only use the word itself, 1STCHAR, which (as in FORTH) will leave behind the address where the variable's value is in memory.

Provisions For Branching

In any event, the value in the accumulator is then compared with the value located in variable 1STCHAR and line four puts a one on the FORTH stack if the compare is true or line six puts a zero on the stack if the bytes are not equal. When control is returned to TEST, it will use the zero or one to decide whether or not to print an address on the screen.

The FORTH assembly process can provide for forward branching. The IF, THEN, structure uses the 0= to test the result of the CMP,. As Program 2 illustrates, a failure of comparison (BNE) is assembled in place of the 0= IF, to skip over the true flag creation of line 4. It uses the address of THEN, to know where to go. In both cases, however, we exit via PUSHOA JMP,. This sends control to a subroutine that returns to FORTH after first pushing onto FORTH's stack a two-byte version of the number found in the accumulator.

There are other ways to return to FORTH. If no stack manipulations are required, NEXT JMP, is the common exit. Some adaptations of FORTH require a word which signals the end of assembly. In the version illustrated here there is no such requirement, but it is helpful to return to decimal mode at the end of a machine language word.

One final note, because FORTH assembly allows multiple mnemonics per line, subroutines can be formatted in a structured way. A comparison of the readability of ?CHAR in Program 1 with its disassembly in Program 2 demonstrates the clarity it is possible to achieve. In addition, comments can be included anywhere by enclosing them in parentheses with a space following the first parenthesis: (comment).

Program 1.

```
SCR # 1ØØ
 Ø 76 VARIABLE 1STCHAR
 1   CODE ?CHAR
 2            1 # LDA, SETUP JSR, N )Y LDA,
 3                   1STCHAR     CMP,
 4          Ø= IF, 1 # LDA, PUSHØA JMP,
 5      THEN,
 6                Ø # LDA, PUSHØA JMP,
 7                          DECIMAL FORTH
 8
 9
1Ø : TEST DUP 1Ø24 + SWAP       DO
11                          I ?CHAR
12                   IF    CR I .    ENDIF
13                           LOOP ;
14
15
```

Program 2.

```
3A34 A9 Ø1    LDA #$Ø1
3A36 2Ø 6A Ø6 JSR $Ø66A
3A39 B1 1Ø    LDA ($1Ø),Y
3A3B CD 3A 39 CMP $393A
3A3E DØ Ø5    BNE $3A45
3A4Ø A9 Ø1    LDA #$Ø1
3A42 4C 7Ø Ø9 JMP $Ø97Ø
3A45 A9 ØØ    LDA #$ØØ
3A47 4C 7Ø Ø9 JMP $Ø97Ø
```

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Odds & Ends: Atari

Add A Text Window To GRAPHICS 0

Charles Brannon
Editorial Assistant

The text window can be a useful feature in the graphics modes, enabling a simultaneous text and graphics display. The text window is very similar to a miniature GRAPHICS 0 text screen: all the editor functions are supported, and scrolling and screen clearing are confined to the small four-line window.

This same capability would be useful for a GRAPHICS 0 display. For example, a menu, a list of choices, could be presented in the top twenty or so lines of the screen, and the user's input taken in the lower four lines of the text window. Any errors, such as the user typing editor keys in an INPUT statement, would not interfere with the rest of the screen. Conveniently, any scrolling when caused by a line like this one:

```
150 PRINT "NAME";:INPUT N$:IF LEN(N$)>8
    THEN PRINT "* TOO LONG *":GOTO 150
```

would not cause the menu above it to scroll as well.

How is all this done? With a single POKE statement. Location 703 normally contains the number 24. If you POKE a four in its place, the cursor is zapped to the bottom of the screen and the text window is in place.

Note that you can't print to the upper part of the screen with PRINT statements; you have to use PRINT#6 as you do with GRAPHICS modes 1 and 2. The POSITION statements also only affect the upper part of the display, you must use POKEs to position text window output.

Here is an example program to demonstrate the use of the window. It is a simple disk menu program. Notice that you don't need to use PRINT#6 to print to the upper part of the screen until after the POKE 703,4 takes place.

```
100 REM DEMONSTRATES "TEXT WINDOW"
110 REM SIMPLE MENU PROGRAM
120 REM FOR DISK DRIVE
130 TRAP 150
140 OPEN #1,6,0,"D:*.*":GOTO 160
150 ? "Can't read directory":END
160 GRAPHICS 0:COL=0:POKE 752,1:REM DISA
BLES CURSOR
170 DIM A$(20),F$(14):TRAP 230
180 INPUT #1;A$
190 POSITION COL,LINE:? A$(1,14)
200 LINE=LINE+1
210 IF LINE>20 THEN COL=COL+13:LINE=0
220 GOTO 180
230 POKE 703,4:REM CREATES TEXT WINDOW
240 FOR I=1 TO 100:? I,:NEXT I:REM ONLY
FOR DEMONSTRATION
250 ? "{CLEAR}Run which program";:INPUT
A$:REM CLEAR ONLY CLEARS WINDOW
260 TRAP 290
270 F$="D:":F$(3)=A$
280 RUN F$
290 ? "Can't RUN ";F$;"."
300 END
```

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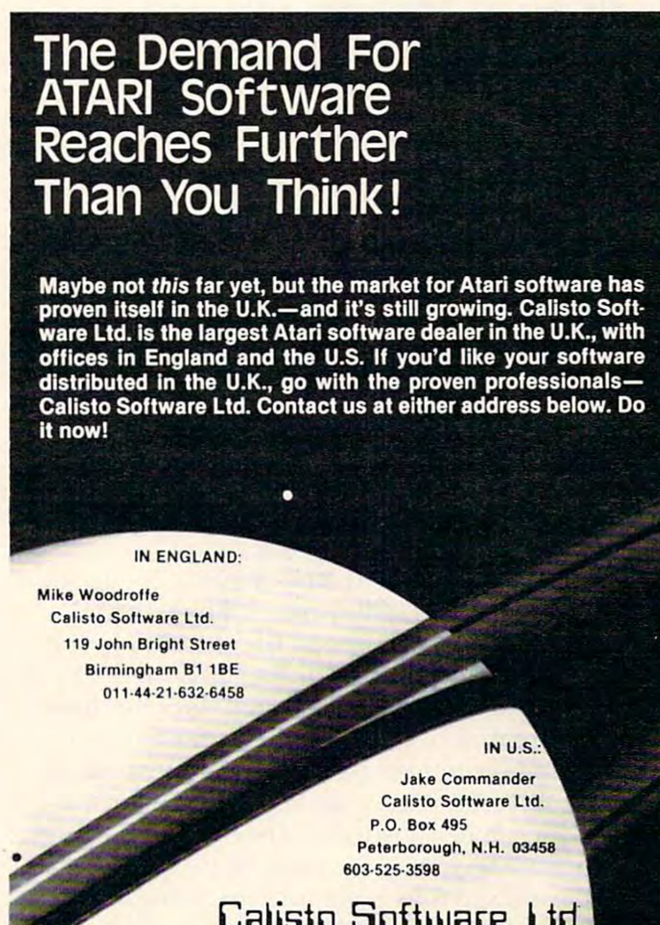

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Here's an alternative to Apple Pascal's Transfer function when you need hardcopy listings.

Apple Pascal Lister

Scott Barrus
Ramsey, NJ

The lister program below is written in modules. The first is self-explanatory. It puts a header on the top of the screen. The second module goes with the first. It is used to delay long enough for a person to read the header. If a shorter or longer time is desired, the number 3000 can be changed.

The module Input puts the prompt "File name" on the left-hand side of the screen, 15 spaces down. It also names a string "namefile" to be used with the names module. If a name is entered without a ".text" on the end, this module attaches it. A possible addition would be to prompt and ask if ".text" were wanted.

The module Names builds and writes the Filename and page # on the top of each sheet. It also then puts 79 " = " 's underneath the filename line. Since Pascal does not have a tab function, either a tab type module would have to be written or, just use spaces to separate the word "page" and file names. If a further right position were wanted, then more blanks could be added or a tab module made up.

Getfile does the hard work. It reads a line from the input file and then writes each line to the printer. It does this 55 times and then sends a form feed to the printer. It will keep doing this until it comes across an end of file (EOF) marker at which time this module ends.

Openfile opens the avenue for the program to work. It opens the text file to be read and it activates the printer as a file named outfile.

Procedure Epson is a bit of customizing because the author uses an MX-80 printer. Since the program can print more than one file at a sitting, the change mode option was added to give the user flexibility. If the printer being used does not have all the capabilities of the Epson, either eliminate the lines that cannot be used or eliminate module Epson. If different codes are used on any printer, those codes can be substituted for the Epson codes.

The final section is the body of the program. The program starts by assigning the value of one to "pagenumbers." A header comes next. The file must be opened so that when we state what Epson code is to be used the printer will be able to get the code. All that is left is to let the program get (and print) out the files. When done, the user is prompted for another file. If none is wanted, the screen is cleared and the user gets a cheerful message. Finally the file opened is closed and the program ends.

To run the program, type X from the main prompt line in Pascal. When asked what file to execute, type in the name that was assigned to the compiled code. To run the program as on the example disk, type in List:Lister.code. The program will be off and running.

```
Program Lister;

  const

     Pagelength = 55;
     Linelength = 79;

  var
    files,
    Pagenumbers,
    time                : Integer;

    Filename,
    Namefile            : String;

    Line,
    Nametitle,
    Separator           : String [ 255 ];

    Infile,
    Outfile             : Text;

    Ans,
    answer,
    choice              : Char;

Procedure Header;
   begin
     page(output);
```

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```
      Writeln('     ******************************');
      Writeln('     *                            *');
      Writeln('     *    Apple Pascal Lister     *');
      Writeln('     *      by Scott Barrus       *');
      Writeln('     *                            *');
      Writeln('     ******************************');
    end;

Procedure Wait;
  begin
    for time := 1 to 3000 do;
  end;

Procedure Input;
  begin
    Page(output);
     Gotoxy(1,15);
     Write('File name: ');
     Readln(filename);
      Namefile := filename;
        if pos('.',filename)=0 then
          filename := concat ( filename,'.text');
  end

Procedure Names;
  begin
  Write(outfile,chr(14),namefile,chr(20));
  Writeln(outfile,'                         Page ',pagenumbers);
    Separator := '=';
   for files := 1 to linelength do
    Separator := concat(Separator,'=');
  Writeln(outfile,Separator);
  Writeln(outfile);
  end;

Procedure Getfile;
  begin
   Repeat
     Names;
     For files := 1 to Pagelength do
       begin
         Readln(infile,line);
         Writeln(outfile,line);
       end;
     Page(outfile);
     pagenumbers := pagenumbers + 1 ;
   Until EOF(infile) = True;
  end;

Procedure OpenFile;
  begin
    Rewrite(outfile,'printer:');
    Reset(infile,filename);
  end;

Procedure Epson;
  begin
    repeat
    Page(output);
      Writeln('Choose:');
      Writeln;
```


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```
    Writeln('(A).......Emphasize');
    Writeln('(B).......Double Strike');
    Writeln('(C).......Both');
    Writeln('(D).......Cnx Either');
    Writeln('(E).......Continue as is');
    Writeln;
    Write('choice: ');
    Readln(choice);
  until choice in [ 'A','a','B','b','C','c','D','d','E','e'];
  case choice of
    'A','a'   : Writeln(outfile,chr(27),'E');
    'B','b'   : Writeln(outfile,chr(27),'B');
    'C','c'   : Writeln(outfile,chr(27),'E',chr(27),'B');
    'D','d'   : begin
              Page(output);
               repeat
                Writeln('Cancel which?');
                Writeln('(A)...Emphase');
                Writeln('(B)...Double Strike');
                Writeln('(C)...Both');
                Writeln('(D)...Continue as is');
                Write('Choice: ');
                Readln(choice);
               until choice in ['A','a','B','b','C','c','D','d'];
               case choice of
                'A','a'  : Writeln(outfile,chr(27),'F');
                'B','b'  : Writeln(outfile,chr(27),'H');
                'C','c'  : Writeln(outfile,chr(27),'F',
                                            chr(27),'H');
                'D','d'  : Exit(Epson);
               end; [ case ]
            end;
      'E','e'   : Exit (Epson);
   end; [ case ]
end; [ epson ]

 Begin [ Main Program ]
    pagenumbers:= 1;
    Header;
     Wait;
    Repeat
       Input;
       Openfile;
         Epson;
       Getfile;
         Write('Another file? (Y/N) ');
         Readln(answer);
   Until answer in ['N','n'];
   Page(output);
   Gotoxy(1,15);
   Writeln('Have a Nice Day!');
   Close (infile);
 end.
```

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Hooking Up DOS Wedge To PETs With Power

Elizabeth Deal
Malvern, PA

Here is a cookbook procedure that allows the use of Commodore's DOS support and/or the Universal Wedge with PETs equipped with Professional Software's Power. It is only for Upgrade PETs. BASIC 4.0 systems don't really need the Wedge.

Follow These 6 Steps Once:

1. Reset the PET and turn POWER on with the usual SYS9*4096. 2. Load the Wedge program. Then get into the monitor with SYS4. 3. Make the listed changes, being careful to make only the changes appropriate for your version of the Wedge program: Old DOS-SUPPORT needs a change in the contents of $0749/A, $074E/F and $0798/9 from 00 76 to FE 97 (jump to Power instead of the CHRGOT routine). It also needs a replacement of the four bytes at $072C to $072F from the existing C9 40 F0 0D to EA EA EA EA (to disable the '@' key). Universal Wedge needs changes in the contents of $0549/A, $054E/F and $0598/9 from 00 76 to FE 97, and replacement of the four bytes at $052C to $052F from C9 40 F0 0D to EA EA EA EA. Remember to push RETURN after each change so your PET can hear you. 4. Save the program under a different name, "PDOS" perhaps. 5. Now RUN the Wedge. If the PET crashed, go back to step 1. 6. Get into the monitor once again and ask for bytes $0070 to 00723 (.M 0070 0072). Write down the two bytes that follow 4C and don't lose the note. This is the wedge's address in 6502 format, low byte first.

In The Future:

Turn Power on, load your newly created wedge, RUN it in the usual fashion, and always remember to write down the contents of $0071/72. (You may need this later, as we shall see.)

What's Happening?

After Power has been set up, we take over and tell the PET to check our Wedge routine before it goes to Power. That's done by the change in $0070/71. In three cases (no recognized wedge command, error channel read and utility commands), the Wedge routine formerly exited to the CHRGOT subroutine ($0076). We force it to go to Power with JMP $97FE (six bytes beyond the start of Power), which is the very change you made in three places to the Wedge code. Printing the directory, load and load/run sections remain intact.

Finally, we eliminate the '@' key from Wedge's repertoire in order to leave it for a more important task in Power's search routine. We did it by replacing four consecutive bytes with $EA (NOP) to skip that code. The '>' (greater than key) and all others remain unchanged.

Assorted Notes

This is just one of many ways the hookup can be achieved. It loosely follows the instructions on page 62 in the Power manual. I think a better way is that described on page 63. However, the method presented here is the simplest to understand and explain. The method on page 63 requires some fiddling with the Wedge code and would require more typing on your part.

You have to remember the address of the Wedge, which is in the two bytes you jotted down. You can use instant key REM macros for remembering them. The reason is that if you use Power's FIX command, Power will stick the old values (its own address) into the CHRGET routine ($0070) and you will have to change them back to point to the Wedge.

If you use the OFF command, Power will replace your address with the regular CHRGET code, also disabling the Wedge. It's best to leave the Wedge disabled until Power is turned on again. Otherwise, if you enable the Wedge by changing the values in the CHRGET routine you will ultimately end up in Power, since that's where we told the Wedge to go when its done. For the same reason you should not use this version of the Wedge if you don't plan to use Power.

Extra Note On The Wedge

I have written recently that the Universal Wedge overshoots its correct loading boundaries when it is RUN. I also incorrectly stated that the old DOS-support does not. Sorry! Both programs do it. The reason is that, as coded, two pages (512 bytes) of code are moved to high memory but the code reserves only enough room for the Wedge code (359 bytes). You can write your own mover as a fix. If not, and if you are loading the Wedge to a place other than near the top of memory you may want to lower the top of memory pointer to accomodate the entire program, otherwise you'll wipe out whatever code you have already placed above the Wedge. This can be done by entering FF in place of 67 in byte $08B2 in the DOS support, or in byte $066B in the Universal Wedge, if you have the room. ©

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A Self-Modifying P/M Graphics Utility

Kenneth Grace, Jr.
Colts Neck, NJ

The utility in Program 1 sets up a skeleton program for player/missile graphics. It presents a series of questions about the P/M situation you want to create and then modifies itself according to your responses. I hope you will find the program useful. But I also hope it will stimulate your thinking on other ways to use the self-modification ability, introduced by Bruce Frumker in **COMPUTE!** (August, 1981 #15). I also want to give some further publicity to a method for controlling P/M motion using string manipulations, as introduced by George Blank in the April 1981 issue of *Creative Computing*.

There are several steps involved in setting up P/M graphics, and they have been covered in **COMPUTE!** and elsewhere. The steps are easy, but there are several choices available along the way (resolution, number of players, colors, positions, etc.). That's where this utility comes in. It contains all the basic steps, and where there are choices to be made, they are presented to you. The program then uses Frumker's technique to add lines to the program. At the end it uses the same technique to delete lines that are not needed, including the lines which ask the questions.

When the utility has finished, you are left with the skeleton of a P/M graphics program. You can RUN it at this point to check things out. But to make it a real program, you will have to draw the playfield and add the main loop for controlling motion, checking collisions, etc. In other words, the utility does just the P/M setup. However, note that there are some subroutines included which you can use for player motion.

Since I make extensive use of Frumker's technique, I have split it into two subroutines, at 9900 and 9910-9920. Between the two subroutine calls I put PRINT statements for the lines to be added to, or deleted from, the program.

Aside from these two subroutines, the heart of the program is in lines 3-66. Lines 3-55 present the series of questions through which you define your particular P/M arrangement. The self-modifying feature is used after every question or two to add the appropriate statements to the section beginning at line 9000. At a few places the program STOPs while you enter lines containing SETCOLOR statements for the playfield colors or DATA statements containing the bytes defining the shapes of the players and missiles.

At the end of this sequence lines 56-66 and 9930 delete lines 3-66, the unneeded P/M motion routines in 100-185 (when you have less than four players and four missiles), and other unneeded lines in 9000-9700. I couldn't figure out how to get rid of all the unnecessary lines, so later you may wish to delete lines 9900-9960.

When the utility has finished, you are left with lines 1-2, 99, appropriate subroutines from 100-185, a trivial loop at 200, and the P/M setup steps starting at 9000. Note that lines 20-24 and 9030 take account of Fred Pinho's rules (**COMPUTE!** September '81, #16) for placing P/M memory so that it doesn't overlap the memory for the BASIC GRAPHICS mode. Starting from this skeleton, I suggest that you use lines 3-98 for REMarks, opening titles, instructions, etc., and begin your main program at line 200.

Motion Using Strings

The string manipulation method for player motion is based on Mr. Blank's column mentioned above. I refer you to that article for a detailed explanation. The basic idea is that you trick your Atari into treating the Player/Missile memory as the string array storage area for PO$,P1$,...,M$. Lines 1-2 and 9500-9580 do this. Atari's fast string handling routines can then be used for vertical motion of the players or for animation.

In order for this to work, PO$,P1$,...,M$ must be the first variables mentioned in the program. I suggest that you turn off power momentarily, then key in line 1 and the rest of the program. In line 2, VTAB is a pointer to the start of the variable table, which contains eight bytes for each variable. ATAB points to the start of the string array table, which is where the actual values are stored. Each pass through lines 9530-9570 modifies the eight bytes for PO$ (or P1$, etc.) in the variable table, including the offset from ATAB where the actual values for PO$ are stored (the P/M graphics memory).

The bytes defining the players are stored in strings DO$,D1$,... at lines 9090, 9140, 9190, etc. Each character in a string is stored in memory as a byte containing the corresponding ATASCII value. In this case, we want our data BYTE treated as though it were already an ATASCII value, so we use D0$(I,I) = CHR$(BYTE). Note that this is a different way of using strings for P/M from Alan Watson's method (**COMPUTE!** September 1981, #16). The demo mirrors Watson's example.

The descriptions D0$,D1$,... are initially read into P/M memory (i.e., into P0$,P1$,...) at lines

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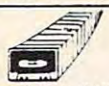
the programmer's program



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9600-9680. The string variable B$ will be our "blanking" string, so we fill it with ATASCII values of zero at line 9690. If you have a player which is no longer than 30 bytes, adjust the DIMension of B$ accordingly.

To produce vertical motion of a player, the subroutines at 100-133 write over the active part of the existing P$ with blanks from B$. Then D$ is written into P$ at the new position, higher or lower than before.

Vertical motion of a missile is slightly more difficult. The problem is that all four missiles are stored in the same memory. Each missile occupies a two-bit slice of the eight-bit bytes in this memory. Thus, we cannot simply write whole new bytes or blanks into this memory.

Instead, using a machine language routine, we AND the existing memory with a binary mask, such as 11111100, leaving zeroes in the appropriate two-bit slice. To this we *add* the new image from DMx$ or B$. The images being added have zeroes outside the two-bit slice, so they won't affect the images of the other missiles.

Lines 9700-9730 read the machine language routine into the string MOVE$. The missile motion subroutines at 150-185 make two USR calls to this routine, once to write the new missile image and once to blank out the rest of the old image. The last variable in the USR call is the decimal equivalent of the binary mask.

Program 2 presents a demonstration of the use of the utility and of the motion routines. The demo attempts to duplicate Watson's animation program. The top part of the listing shows the answers you should give to the questions presented by the utility. The bottom part shows the lines to be added to the skeleton. Lines 300-530 match Watson's line numbers as closely as possible. A comparison of this demo with Watson's program shows that the motion here is somewhat faster – listen to the rate of the "footsteps."

There you have it – a useful utility, a thought-provoker on self-modifying programs, and a neat way to move those spaceships!

Mr. Grace has offered to save you the work of keying in this lengthy program. Just send a stamped, self-addressed mailer, $3 and a blank cassette to 33 Dana Lane, Colts Neck, NJ 07722.

Program 1.

```
1 DIM P0$(1),P1$(1),P2$(1),P3$(1),M$(1)
2 VTAB=PEEK(134)+256*PEEK(135):ATAB=PEEK
(140)+256*PEEK(141)
3 GRAPHICS 17:POSITION 2,3:? #6;"A SELF-
MODIFYING":POSITION 3,6:? #6;"PLAYER-MIS
SILE":POSITION 2,9
4 ? #6;"GRAPHICS UTILITY":POSITION 6,16:
? #6;"ken grace":FOR T=1 TO 3000:NEXT T
5 GRAPHICS 0:? :? "THIS UTILITY PRESENTS
 A SERIES OF     QUESTIONS BY WHICH YOU
DEFINE A       PLAYER-MISSILE GRAPHICS";
6 ? " SETUP.":? :? "IT THEN MODIFIES ITS
ELF INTO A PROGRAMSKELETON.":? :? "SUBRO
UTINES FOR PLAYER AND MISSILE "
7 ? "MOTION ARE INCLUDED.":? :? "YOU ADD
 THE REST OF THE PROGRAM.":? :? "ANIMATI
ON IS POSSIBLE BY COPYING NEW "
8 ? "SHAPE STRINGS INTO THE STRINGS":? "
DEFINING THE PLAYERS.":? :? :? "PRESS |S
TART| TO BEGIN."
9 X=PEEK(53279):IF X<>6 THEN 9
10 ? "{CLEAR}ENTER THE |BASIC| GRAPHICS
MODE FOR PLAYFIELD":? "GR. ";:INPUT X:GO
SUB 90:? "9000 GRAPHICS ";X:GOSUB 91
11 ? "DO YOU WANT STANDARD COLORS FOR ":
? "GRAPHICS ";X;:DIM X$(3):INPUT X$:IF X
$(1,1)="Y" THEN 13
12 ? :? "USE LINES 9800-9850 TO ENTER |S
ETCOLOR| STATEMENTS.  TYPE |CONT| WHEN Y
OU ARE   READY TO CONTINUE.":STOP
13 ? CHR$(125):? :? "RESOLUTION DESIRED
FOR PLAYERS:":? "0 = DOUBLE-LINE":? "1 =
 SINGLE-LINE (FINER)":INPUT R
14 Y=INT(X/16):X=X-16*Y:IF X<=4 THEN S=8
*(1+R)
15 IF X=5 THEN S=12+4*R
16 IF X=6 THEN S=16+8*R
17 IF X=7 THEN S=24+8*R
18 IF X=8 THEN S=36+4*R
19 GOSUB 90:? "9010 RES=";R;":S=";S:GOSU
B 91
20 ? "NUMBER OF PLAYERS TO BE DEFINED";:
INPUT NP
21 FOR I=0 TO NP-1:? CHR$(125):? :? "COL
OR (0 - 15) AND INTENSITY (0 - 15) FOR P
LAYER ";I;:INPUT X,Y
22 GOSUB 90:? 9050+I;" POKE ";704+I;",";
16*X+Y:GOSUB 91
23 ? "WIDTH OF PLAYER ";I;":":? "0 = NOR
MAL":? "1 = TWICE NORMAL":? "3 = FOUR TI
MES NORMAL":INPUT X
24 GOSUB 90:? 9060+I;" POKE ";53256+I;",
";X:GOSUB 91
30 ? "INITIAL HORIZONTAL POSITION (0 - 2
55) FOR LEFT EDGE OF PLAYER ";I;" (40 TO
 215ON SCREEN)";:INPUT X
31 GOSUB 90:? 9070+I;" POKE ";53248+I;",
";X;":XP";I;"=";X;":REM XP";I;" IS HORIZ
 POS OF PLAYER ",I:GOSUB 91
32 ? "VERTICAL LENGTH (BYTES) OF PLAYER
";I;:INPUT X:? CHR$(125):?
```

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```
33 ? "INITIAL VERTICAL POSITION OF TOP O
F   PLAYER  (1 TO ";128*(1+R)-X+1;")";:I
NPUT Y:GOSUB 90
34 ? 9080+50*I;"YP";I;"=";Y;":LP";I;"=";
X;":REM VERTICAL POSITION AND LENGTH OF
PLAYER ";I:GOSUB 91
35 ? "USE LINE ";9100+50*I;" (TO ";9129+
50*I;") TO ENTER DATA STATEMENTS WITH TH
E ";X;" BYTES DEFINING  PLAYER ";I
36 ? :? "TYPE |CONT| TO WHEN FINISHED.":
STOP
40 NEXT I:? CHR$(125):S=0
41 ? :? "HOW MANY MISSILES TO BE DEFINED
 (0 TO 4)";:INPUT NM:IF NM=0 THEN ? CHR$
(125):GOTO 52
42 FOR I=0 TO NM-1:? CHR$(125):? :? "WID
TH OF MISSILE ";I:? "0 = NORMAL":? "1 =
TWICE NORMAL"
43 ? "3 = FOUR TIMES NORMAL":INPUT X:S=I
NT(4^I+0.1)*X+S:GOSUB 90:? "9064 POKE 53
260,";S:GOSUB 91
44 ? "INITIAL HORIZONTAL POSITION OF MIS
SILE";I;:INPUT X:GOSUB 90:? 9074+I;" POK
E ";53252+I;",";X;":XM";I;"=";X
45 GOSUB 91:? "VERTICAL LENGTH (BYTES) O
F MISSILE ";I:INPUT X:? CHR$(125)
46 ? :? "INITIAL VERTICAL POSITION OF TO
P OF   MISSILE (1 TO ";128*(1+R)-X+1;")"
:INPUT Y
47 GOSUB 90:? 9280+50*I;" YM";I;"=";Y;":
LM";I;"=";X;":REM VERTICAL POSITION AND
LENGTH OF MISSILE";I:GOSUB 91
48 ? "USE LINE ";9300+50*I;" (TO ";9329+
50*I;") TO ENTER DATA STATEMENTS WITH TH
E ";X;" 'BYTES' DEFINING"
49 ? "MISSILE ";I:X=INT(4^I+0.1):? :? "A
LLOWED VALUES ARE 0, ";X;", ";2*X;", OR
";3*X:?
50 ? "ENTER |CONT| WHEN FINISHED.":STOP

51 NEXT I:? CHR$(125):?
52 ? "PRIORITY SCHEDULE :":? :? "1 - PLA
YERS 0-3,PLAYFLDS 0-3,BACKGND":? :? "2 -
 PLAYERS 0-1,PLAYFLDS 0-3,PLAYERS"
53 ? "   2-3,BACKGND":? :? "4 - PLAYFLDS
 0-3,PLAYERS 0-3,BACKGND":? :? "8 - PLAY
FLDS 0-1,PLAYERS 0-3,PLAYFLDS"
54 ? "   2-3,BACKGND":? :? "ALSO, THE NU
MERICAL SUMS OF THE ABOVE CHOICES ARE AL
LOWED, GIVING BLACK FOR OVERLAPS."
55 ? :? "ABOVE +32 GIVES COLOR IN OVERLA
PS":? :? "CHOICE";:INPUT X:GOSUB 90:? "9
045 POKE 623,";X:GOSUB 91
56 ? :? "PLEASE WAIT FOR PROCESSING.":?
```


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```
57 FOR I=3 TO 9:? I:NEXT I:GOSUB 91:GOSU
B 90:FOR I=10 TO 24:? I:NEXT I:GOSUB 91
58 GOSUB 90:FOR I=30 TO 45:? I:NEXT I:GO
SUB 91
59 GOSUB 90:FOR I=46 TO 50:? I:NEXT I:GO
SUB 91
60 IF NM<4 THEN FOR I=NM TO 3:GOSUB 90:F
OR J=0 TO 5:? 150+J+10*I:NEXT J:GOSUB 91
:NEXT I
61 IF NM<4 THEN GOSUB 90:FOR I=NM TO 3:?
 9285+50*I:? 9290+50*I:NEXT I:GOSUB 91
62 IF NM<4 THEN GOSUB 90:FOR I=NM TO 3:?
 9650+10*I:NEXT I:GOSUB 91
63 IF NM=0 THEN GOSUB 90:FOR I=0 TO 7:?
9700+10*I:NEXT I:GOSUB 91
64 IF NP<4 THEN FOR I=NP TO 3:GOSUB 90:F
OR J=0 TO 6:? 100+10*I+J:NEXT J:GOSUB 91
:NEXT I
65 IF NP<4 THEN GOSUB 90:FOR I=NP TO 3:?
 9085+50*I:? 9090+50*I:? 9600+10*I:NEXT
I:GOSUB 91
67 GOSUB 90:FOR I=51 TO 65:? I:NEXT I:GO
SUB 91
68 ? :? :? "67":? "68":? "90":? "91":? "
92":? "POKE 842,12:? CHR$(125)":POSITION
 0,0:POKE 842,13:STOP
90 SETCOLOR 1,9,4:? CHR$(125):? :RETURN
91 ? :? :? "CONT":POSITION 0,0:POKE 842,
13:STOP
92 POKE 842,12:? CHR$(125):? :SETCOLOR 1
,9,10:RETURN
99 GOTO 9000
100 REM MOTION OF PLAYER 0. XP0 AND YP0
ARE X,Y POSITIONS. DX0 AND DY0 ARE CHANG
ES.
101 TRAP 106:IF DY0<>0 THEN 103
102 POKE 53248,XP0+DX0:GOTO 105
103 IF DY0<0 THEN P0$(YP0+DY0,YP0+LP0+DY
0-1)=D0$:P0$(YP0+LP0+DY0,YP0+LP0-1)=B$(1
,-DY0):GOTO 105
104 P0$(YP0,YP0+DY0-1)=B$(1,DY0):P0$(YP0
+DY0,YP0+LP0+DY0-1)=D0$
105 XP0=XP0+DX0:YP0=YP0+DY0:DX0=0:DY0=0:
RETURN
106 DX0=0:DY0=0:POKE 53248,XP0:P0$(YP0,Y
P0+LP0-1)=D0$:RETURN
110 REM MOTION OF PLAYER 1.
111 TRAP 116:IF DY1<>0 THEN 113
112 POKE 53249,XP1+DX1:GOTO 115
113 IF DY1<0 THEN P1$(YP1+DY1,YP1+LP1+DY
1-1)=D1$:P1$(YP1+LP1+DY1,YP1+LP1-1)=B$(1
,-DY1):GOTO 115
114 P1$(YP1,YP1+DY1-1)=B$(1,DY1):P1$(YP1
+DY1,YP1+LP1+DY1-1)=D1$
115 XP1=XP1+DX1:YP1=YP1+DY1:DX1=0:DY1=0:
RETURN
```


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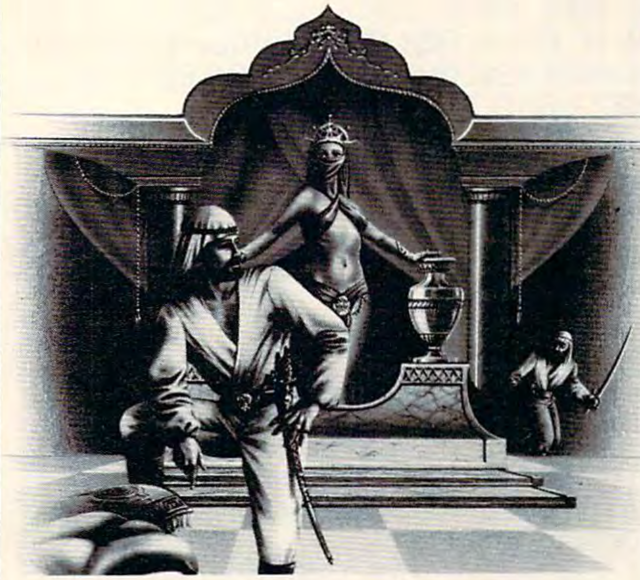

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```
:? "WHEN YOU SEE |READY| YOU MAY LIST OR
 RUN":FOR X=1 TO 900:NEXT X:GOSUB 90
116 DX1=0:DY1=0:POKE 53249,XP1:P1$(YP1,Y
P1+LP1-1)=D1$:RETURN
120 REM MOTION OF PLAYER 2.
121 TRAP 126:IF DY2<>0 THEN 123
122 POKE 52350,XP2+DX2:GOTO 125
123 IF DY2<0 THEN P2$(YP2+DY2,YP2+LP2+DY
2-1)=D2$:P2$(YP2+LP2+DY2,YP2+LP2-1)=B$(1
,-DY2):GOTO 125
124 P2$(YP2,YP2+DY2-1)=B$(1,DY2):P2$(YP2
+DY2,YP2+LP2+DY2-1)=D2$
125 XP2=XP2+DX2:YP2=YP2+DY2:DX2=0:DY2=0:
RETURN
126 DX2=0:DY2=0:POKE 53250,XP2:P2$(YP2,Y
P2+LP2-1)=D2$:RETURN
130 REM MOTION OF PLAYER 3.
131 TRAP 136:IF DY3<>0 THEN 133
132 POKE 53251,XP3+DX3:GOTO 135
133 IF DY3<0 THEN P3$(YP3+DY3,YP3+LP3+DY
3-1)=D3$:P3$(YP3+LP3+DY3,YP3+LP3-1)=B$(1
3-1)=D3$:P3$(YP3+LP3+DY3,YP3+LP3-1)=B$(1
,-DY3):GOTO 135
134 P3$(YP3,YP3+DY3-1)=B$(1,DY3):P3$(YP3
+DY3,YP3+LP3+DY3-1)=D3$
135 XP3=XP3+DX3:YP3=YP3+DY3:DX3=0:DY3=0:
RETURN
136 DX3=0:DY3=0:POKE 53251,XP3:P3$(YP3,Y
P3+LP3-1)=D3$:RETURN
150 REM MOTION OF MISSILE 0. XM0,YM0  AR
E X,Y COORDS. DXM0,DYM0 ARE CHANGES
151 TRAP 155:IF YM0+DYM0<1 OR YM0+DYM0+L
M0>128*(1+RES) OR DYM0=0 THEN DYM0=0:GOT
O 154
152 IF DYM0>0 THEN Z=USR(MOVE,M+YM0+DYM0
,DM0,LM0,252):Z=USR(MOVE,M+YM0,B,DYM0,25
2):GOTO 154
153 Z=USR(MOVE,M+YM0+DYM0,DM0,LM0,252):Z
=USR(MOVE,M+YM0+LM0+DYM0,B,-DYM0,252)
154 YM0=YM0+DYM0:POKE 53252,XM0+DXM0:XM0
=XM0+DXM0:DXM0=0:DYM0=0:RETURN
155 POKE 53252,XM0:DXM0=0:DYM0=0:RETURN
160 REM MOTION OF MISSILE 1
161 TRAP 165:IF YM1+DYM1<1 OR YM1+DYM1+L
M1>128*(1+RES) OR DYM1=0 THEN DYM1=0
162 IF DYM1>0 THEN Z=USR(MOVE,M+YM1+DYM1
,DM1,LM1,243):Z=USR(MOVE,M+YM1,B,DYM1,24
3):GOTO 164
163 Z=USR(MOVE,M+YM1+DYM1,DM1,LM1,243):Z
=USR(MOVE,M+YM1+LM1+DYM1,B,-DYM1,243)
164 YM1=YM1+DYM1:POKE 53253,XM1+DXM1:XM1
=XM1+DXM1:DXM1=0:DYM1=0:RETURN
165 POKE 53253,XM1:DXM1=0:DYM1=0:RETURN
170 REM MOTION OF MISSILE 2
171 TRAP 174:IF YM2+DYM2<1 OR YM2+DYM2+L
M2>128*(1+RES) OR DYM2=0 THEN DYM2=0:GOT
O 174
172 IF DYM2>0 THEN Z=USR(MOVE,M+YM2+DYM2
,DM2,LM2,207):Z=USR(MOVE,M+YM2,B,DYM2,20
7):GOTO 174
173 Z=USR(MOVE,M+YM2+DYM2,DM2,LM2,207):Z
=USR(MOVE,M+YM2+LM2+DYM2,B,-DYM2,207)
174 YM2=YM2+DYM2:POKE 53254,XM2+DXM2:XM2
=XM2+DXM2:DXM2=0:DYM2=0:RETURN
175 POKE 53254,XM2:DXM2=0:DYM2=0:RETURN
180 REM MOTION OF MISSILE 3
181 TRAP 184:IF YM3+DYM3<1 OR YM3+DYM3+L
M3>128*(1+RES) OR DYM3=0 THEN DYM3=0:GOT
O 184
182 IF DYM3>0 THEN Z=USR(MOVE,M+YM3+DYM3
,DM3,LM3,63):Z=USR(MOVE,M+YM3,B,DYM3,63)
:GOTO 184
183 Z=USR(MOVE,M+YM3+DYM3,DM3,LM3,63):Z=
USR(MOVE,M+YM3+LM3+DYM3,B,-DYM3,63)
184 YM3=YM3+DYM3:POKE 53255,XM3+DXM3:XM3
=XM3+DXM3:DXM3=0:DYM3=0:RETURN
185 POKE 53255,XM3:DXM3=0:DYM3=0:RETURN
200 GOTO 200
9015 POKE 559,46+16*RES
9020 PMBASE=PEEK(106)-S:POKE 54279,PMBAS
E:PMBASE=PMBASE*256
9030 POKE 53277,3
9085 DIM D0$(LP0)
9090 RESTORE 9100:FOR I=1 TO LP0:READ BY
TE:D0$(I,I)=CHR$(BYTE):NEXT I
9135 DIM D1$(LP1)
9140 RESTORE 9150:FOR I=1 TO LP1:READ BY
TE:D1$(I,I)=CHR$(BYTE):NEXT I
9185 DIM D2$(LP2)
9190 RESTORE 9200:FOR I=1 TO LP2:READ BY
TE:D2$(I,I)=CHR$(BYTE):NEXT I
9235 DIM D3$(LP3)
9240 RESTORE 9250:FOR I=1 TO LP3:READ BY
TE:D3$(I,I)=CHR$(BYTE):NEXT I
9285 DIM DM0$(LM0)
9290 RESTORE 9300:FOR I=1 TO LM0:READ BY
TE:DM0$(I,I)=CHR$(BYTE):NEXT I:DM0=ADR(D
M0$)
9335 DIM DM1$(LM1)
9340 RESTORE 9350:FOR I=1 TO LM1:READ BY
TE:DM1$(I,I)=CHR$(BYTE):NEXT I:DM1=ADR(D
M1$)
9385 DIM DM2$(LM2)
9390 RESTORE 9400:FOR I=1 TO LM2:READ BY
TE:DM2$(I,I)=CHR$(BYTE):NEXT I:DM2=ADR(D
M2$)
9435 DIM DM3$(LM3)
9440 RESTORE 9450:FOR I=1 TO LM3:READ BY
TE:DM3$(I,I)=CHR$(BYTE):NEXT I:DM3=ADR(D
M3$)
```

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```
9490 FOR I=PMBASE+384*(1+RES) TO PMBASE+
1024*(1+RES):POKE I,0:NEXT I
9500 OFFSET=PMBASE+512*(1+RES)-ATAB
9510 FOR I=0 TO 4
9520 V3=INT(OFFSET/256):V2=OFFSET-256*V3

9530 POKE VTAB+2,V2:POKE VTAB+3,V3
9540 POKE VTAB+4,128*(1-RES):POKE VTAB+5
,RES
9550 POKE VTAB+6,128*(1-RES):POKE VTAB+7
,RES
9560 VTAB=VTAB+8:OFFSET=OFFSET+128*(1+RE
S)
9570 IF I=3 THEN OFFSET=PMBASE+384*(1+RE
S)-ATAB
9580 NEXT I
9600 P0$(YP0,YP0+LP0-1)=D0$
9610 P1$(YP1,YP1+LP1-1)=D1$
9620 P2$(YP2,YP2+LP2-1)=D2$
9630 P3$(YP3,YP3+LP3-1)=D3$
9650 M$(YM0,YM0+LM0-1)=DM0$
9660 FOR I=1 TO LM1:J=YM1+I-1:M$(J,J)=CH
R$(ASC(M$(J,J))+ASC(DM1$(I,I))):NEXT I
9670 FOR I=1 TO LM2:J=YM2+I-1:M$(J,J)=CH
R$(ASC(M$(J,J))+ASC(DM2$(I,I))):NEXT I
9680 FOR I=1 TO LM3:J=YM3+I-1:M$(J,J)=CH
R$(ASC(M$(J,J))+ASC(DM3$(I,I))):NEXT I
9690 DIM B$(30):FOR I=1 TO 30:B$(I,I)=CH
R$(0):NEXT I:B=ADR(B$)
9700 DIM MOVE$(38):MOVE=ADR(MOVE$):M=ADR
(M$)-1
9705 RESTORE 9720
9710 FOR I=1 TO 37:READ BYTE:MOVE$(I,I)=
CHR$(BYTE):NEXT I
9720 DATA 104,104,133,204,104,133,203,10
4,133,206,104,133,205,104,104,133,207,10
4,104,133,208
9730 DATA 160,0,177,203,37,208,113,205,1
45,203,200,196,207,208,243,96
9999 GOTO 200
```

Program 2. Animation Demo

RUN the utility in Listing 1 and give the following answers:

Graphics Mode: 18
Default Colors: NO

9010 SETCOLOR 4,7,2
CONT

Resolution: 0
Number of Players: 1
Color, Intensity: 1,6
Width: 0
Horizontal Position: 127
Length: 9
Vertical Position: 63

9100 DATA 126,90,66,60,219,189,102,102,231

CONT
Number of Missiles: 0
Priority: 0

Then add the following lines to the skeleton program:

```
200 DIM D01$(9),D02$(9),D03$(9)
210 D01$=D0$
220 RESTORE 520
230 FOR I=1 TO 9:READ BYTE:D02$(I,I)=CHR
$(BYTE):NEXT I
240 FOR I=1 TO 9:READ BYTE:D03$(I,I)=CHR
$(BYTE):NEXT I
300 REM *** VIEW POINTER & STRING ***
310 C=C+1
320 IF C>4 THEN C=1
330 ON C GOTO 340,350,340,360
340 D0$=D01$:GOTO 370
350 D0$=D02$:GOTO 370
360 D0$=D03$
370 P0$(YP0,YP0+LP0-1)=D0$
380 FOR I=1 TO 9
385 IF C=2 OR C=4 THEN SOUND 0,28*I,6,9-
I
390 NEXT I
400 REM *** MOTION ROUTINE ***
410 A=STICK(0)
420 IF A=11 THEN XP0=XP0-1:POKE 53248,XP
0
430 IF A=11 THEN XP0=XP0-1:POKE 53248,XP
0
440 IF A=7 THEN XP0=XP0+1:POKE 53248,XP0

450 IF A=13 THEN DY0=1:GOSUB 100
460 IF A=14 THEN DY0=-1:GOSUB 100
470 GOTO 310
520 DATA 126,90,66,60,219,189,102,230,7
530 DATA 126,90,66,60,219,189,102,103,22
4
```

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VIC/PET BASIC Program Transfers

Jim Butterfield
Toronto

BASIC programs flow easily from the PET to the VIC. VIC has a relocating feature that repacks the incoming program into whatever space that VIC has available. That's a necessary trick: BASIC may start in any of three different locations within the VIC depending on what extra memory has been plugged in.

It's a little more difficult to transfer programs from the VIC to the PET. The stable PET/CBM system expects a BASIC program to be set up for one specific start location. The PET isn't equipped to handle this flighty VIC format which seems to hop around from place to place.

So for VIC-to-PET transitions we need to cope with a "memory mapping" problem. There are several ways to approach this; some of my favorites are itemized below.

Keep in mind that we're discussing BASIC programs only. Machine Language may need different and special handling. And don't forget: PEEKs, POKEs, WAITs, USRs, and SYS's will probably need coding changes to work successfully in the new environment.

A Few Methods:

1. LOAD the program into the VIC with the 3K expansion module in place. SAVE the program. The program will load correctly into the PET with no further modifications needed.

Note that the VIC must have the 3K expansion and no other. The 8K expansion job won't work.

2. Before loading the VIC program into the PET, type NEW; then FOR J=0 TO 2:POKE 4096+J,0:POKE 4608+J,0:NEXT J.

Load the program into the PET. Type LIST. If the program isn't there, type POKE 41,16. Type LIST. If the program still isn't there, type POKE 41,18.

Don't forget to reset your PET when you've finished playing with the VIC program.

Each of the above combinations corresponds to a VIC configuration at the time the program was saved. If 3K expansion was in place, the first LIST will work without any POKE (see method 1). If no memory expansion was there, POKE 41,16 will do the trick. If 8K or more was there, POKE 41,18 is the magic combination.

3. There's another technique available called a Merge. Space is insufficient to outline the whole story here. Suffice it to say that you can use a complex piece of magic to perform a cassette tape Merge; you can use special software for a disk Merge (for example, Power has this feature) or you can use a machine language program specially written to do the trick.

The capability of merging BASIC lines together is quite important: its usefulness extends far beyond the simple objective of transferring programs between machines. [*See "BASIC Program Merges" in this issue.*] ©

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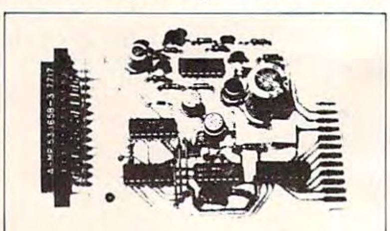

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Part I of this article appeared in the March, 1982, issue and Part II appeared last month. This completes the routines which comprise the Supermonitor for the Ohio Scientific Superboard Computer.

Supermonitor: Part III

Frank Cohen
Pacific Palisades, CA

Here is the conclusion to a long and complex program which adds functions to a Superboard II which you would normally find only in an advanced operating system. These functions make it easy to display, move, and modify machine language programs and data.

The programs listed so far have made up the framework of the Supermonitor. The first program presented was called Hexdump and did nothing more than dump an address and eight bytes of data onto the screen. Hexdump was listed first because subsequent programs use some of its subroutines. The second article included two programs. Indata prints a line of eight bytes of data and allows you to modify the contents. After you have modified a byte, Indata allows you to move forward, backward, or skip over subsequent memory locations. Bmove is a simple block move program. Bmove moves a whole block of memory to another location in memory. With just these three programs, entering and editing maching language data is much more efficient and easy than using the ROM Monitor program OSI supplies.

Without a disk system, loading Supermonitor in its entirety takes about five minutes with the Superboard's 300 baud cassette interface. With the assembly listings of Supermonitor you can use only the programs you find interesting. By doing this, you can limit the size of Supermonitor. The listing of the main menu program shows all the equates for all the programs.

All of the programs of Supermonitor use a program called Supercursor V1.3 (**COMPUTE!**, December, 1981, #19, p. 124) to handle its video output. Supermonitor is installed directly below Supercursor at the top of an 8K byte Superboard II. If you don't want to use Supercursor, you can write your own video output routines. To use Supercursor V1.3 a program puts the ASCII character in the CPU's accumulator and executes a JSR to its start address, located at $1E80. Supercursor also has routines to "Home" the cursor and clear the screen. To use the Home functions, jump to the subroutine at $1E80 using a JSR. Use the same instruction to clear the screen at $1EC2.

A Brief Review

Let's go over some terms. An *assembler* is nothing more than a program which takes programs called *source code* and converts them into machine instructions (called *object code*) which can be directly executed by your computer. Assembly language is made up of three-letter codes which abbreviate what the CPU [*Central Processing Unit*] executes. For example, one commonly used instruction is the "load the accumulator" instruction. In machine language, the code is an A9 followed by the byte to be loaded into the accumulator. In assembly language, the instruction looks something like this: LDA. This stands for LoaD Accumulator. But load it with what?

The 6502 microprocessor has twelve different addressing modes. So, following the LDA instruction, the assembler looks for the type of addressing to use. One of the most common is the *immediate mode*. To load the accumulator with the value 00 (hex) the assembler instruction looks like this: LDA #$00. The pounds sign (#) stands for immediate addressing and the dollar sign ($) tells the assembler that this is a hexadecimal number. If you left out the pounds sign, the assembler would think that you want to load the accumulator with a byte residing at location $00 in the zero page of memory. Executing an instruction like LDA $1000 tells the assembler to load the accumulator with the byte at location $1000 in memory. Labels may be used instead of the actual numbers.

These labels are called *equates*. Before entering the program into the assembler labels can be defined. By defining the labels, specific numbers are assigned to alphanumeric names. In the listing of the main menu program, the major equates are shown. For example, the equate named *cursor* is assigned the value $1E40. So, when we tell the assembler to jump to a subroutine called *cursor* (JSR CURSOR) the assembler will execute the subroutine starting at $1E40. Using equates, assembly language becomes easier to read.

Main Menu

This is by far the simplest of the programs. By entering at $1A7B (called SPMON) the program first clears the screen, then homes the cursor and reads the keyboard. When a key is pressed, it checks to see if it is a valid character. If it is, we jump to the correct program. If not, the screen is cleared and we return to the beginning of the program. The valid characters are listed below:

G – EXECUT, transfers control to a machine language program

I – INDATA, displays and modifies memory

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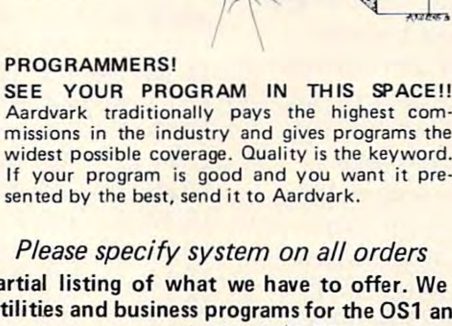

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C – CLEAR, clears the screen
D – HXDMP, dumps memory to the screen
M – BMOVE, moves a block of data
S – TAPOUT, saves a block of data to cassette tape
F – FILL, fill a block of memory with a specified byte

As it is listed, SPMON fits directly under all the other programs. It uses the clear screen and home cursor functions of Supercursor and a subroutine in the ROM monitor (at $FFBA) to get a key from the keyboard.

Execut

If SPMON is the simplest of the programs, EXECUT is the smallest. Most of EXECUT is devoted to input the starting address of the machine language program. EXECUT prints "G=" on the screen and expects you to type in the four digit address. An infrequently used instruction is applied to jump to the address. This instruction is called the "jump indirect" instruction. EXECUT uses the INADR subroutine in HXDUMP to input the address to locations $00E7 and $00E8. We then use the jump indirect instruction to use these addresses.

Fill

This program is similar to BMOVE. FILL loads a block of memory with some value you input. It starts by asking the beginning address of memory by printing "S=" on the screen. Type in the four digit hexadecimal address. FILL then asks for the ending address by printing "E=". Again, input the address. Then it asks what the block of memory is to be filled with. FILL is a very fast program and will fill all 64K in about two seconds. FILL is listed to fit after the main menu and before the cassette tape program.

Tapout

This is the most valuable program. There exist programs that save from machine language to tape, but the problem is that BASIC uses almost all of the zero page memory locations and some of the main memory making it difficult to work around. Since the Superboard's ROM monitor already has a tape input routine, this program only stores data onto cassette.

TAPOUT makes use of BASIC's cassette output subroutine stored in ROM. By setting location $0205 to FF (hex) a jump to subroutine instruction outputs the contents of the accumulator to the cassette interface at 300 baud. After TAPOUT is finished, it resets location $0205 to 00. If you want to use TAPOUT from a machine language program, put the starting address at location $00E9 and $00EA and also the ending address at location $00E7 and $00E8. Then execute the program.

After you install the three programs in this issue, it is necessary to make some slight modifications so that all the programs will return control to the main menu program. To do this you will need to enter the following modifications:

```
1C36   4C   7E   1A   ;For BMOVE
1CB0   4C   7E   1A   ;For INDATA
1D1D   4C   7E   1A   ;For HEXDUMP
1D38   F0   E3
```

```
;EQUATES
CURSOR        =$1E40
CLS           =$1EC2
HOME          =$1E80
INADR         =$1D93
CR            =$1E95
LF            =$1EAB
KEYIN         =$FFBA
EXECUT        =$1ABA
FILL          =$1ACA
TAPOUT        =$1B3F
BMOVE         =$1BC6
INDATA        =$1C56
HXDMP         =$1D20
ADR           =$E7
EBAD          =$E9
SBAD          =$EB
TMP           =$ED
CVAHX         =$1DF3
CVHA          =$1D72
OFLAG         =$0205
AOUT          =$FFEE
```

```
1A7B 20 C2 1E 20 80 1E A9 24
1A83 20 40 1E 20 BA FF C9 47
1A8B D0 03 4C BA 1A C9 49 D0
1A93 03 4C 56 1C C9 4C D0 03
1A9B 4C 7B 1A C9 44 D0 03 4C
1AA3 20 1D C9 4D D0 03 4C C6
1AAB 1B C9 53 D0 03 4C 3F 1B
1AB3 C9 46 D0 C4 4C CA 1A A9
1ABB 47 20 40 1E A9 3D 20 40
1AC3 1E 20 96 1D 6C E7 00 20
1ACB 80 1E A9 53 20 40 1E A9
1AD3 3D 20 40 1E 20 96 1D A5
1ADB E7 85 E9 A5 E8 85 EA 20
1AE3 95 1E 20 AB 1E A9 45 20
1AEB 40 1E A9 3D 20 40 1E 20
1AF3 96 1D 20 95 1E 20 AB 1E
1AFB A9 42 20 40 1E A9 3D 20
1B03 40 1E 20 BA FF 20 40 1E
1B0B 20 F3 1D 0A 0A 0A 0A 85
1B13 ED 20 BA FF 20 40 1E 20
1B1B F3 1D 18 65 ED 85 ED A5
1B23 ED A0 00 91 E9 E6 E9 A5
1B2B E9 D0 02 E6 EA A5 E9 C5
1B33 E7 D0 EC A5 EA C5 E8 D0
1B3B E6 4C 7E 1A 20 80 1E A9
1B43 53 20 40 1E A9 3D 20 40
1B4B 1E 20 96 1D A5 E7 85 E9
1B53 A5 E8 85 EA A9 45 20 40
1B5B 1E A9 3D 20 40 1E 20 96
1B63 1D A9 FF 8D 05 02 A9 2E
1B6B 20 EE FF A5 EA 20 A5 1B
1B73 A5 E9 20 A5 1B A9 2F 20
```

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Machine Language: First Steps, Part II

Jim Butterfield
Toronto

In the last episode, our hero, F. R. Vescent has started to convert the following bar graph program from BASIC to machine language:

```
200 DATA 15,10,30,35,28,28,15,0
210 READ V:IF V=0 GOTO 300
220 J=48:FOR K=1 TO J
230 J=J+1:IF J=58 THEN J=48
240 PRINT CHR$(J);
250 NEXT K
260 PRINT
270 GOTO210
300 END
```

He has coded lines 220 to 260 inclusive to read:

```
        LDX  #$30
        LDY  #$01
YLOOP   INX
        CPX  #$3A
        BNE  SKIP
        LDX  #$30
SKIP    TXA
        JSR  $FFD2
        INY
        CPY  $0300
        BCC  YLOOP
        LDA  #$0D
        JSR  $FFD2
        RTS
```

He puzzles for a moment over the BCC YLOOP; he knows that this is equivalent to Branch-Less-Than; and this will cause the loop to be executed one time too few. After a few moments thought, he changes the LDY #$01 to LDY #$00; that should do the job. Now he's ready to translate the above Assembler code into machine code, which is what the computer really needs.

The coding will be placed in the PET's first cassette buffer, which starts at hexadecimal address 027A; this is noted at the left of the first line. Now, F. R. looks up LDX in his table of Op Codes, and finds that there are about five different ways the instruction can work. The one he wants is Immediate Mode – flagged by the "#" sign in the operand. That translates to hex A2, so he adds to the first line to make:

```
027A A2 30        LDX #$30
```

Counting off the address bytes, he decides that the next address must start at hex 027C. He writes this value at the left of the second line. Continuing the translation, he gets:

```
027A  A2  30              LDX  #$30
027C  A0  00              LDY  #$00
027E  E8           YLOOP  INX
027F  E0  3A              CPX  #$3A
0281  D0  02              BNE  SKIP
0283  A2  30              LDX  #$30
0285  8A           SKIP   TXA
0286  20  D2  FF          JSR  $FFD2
0289  C8                  INY
028A  CC  00  03          CPY  $0300
028D  90  EF              BCC  YLOOP
028F  A9  0D              LDA  #$0D
0291  20  D2  FF          JSR  $FFD2
0294  60                  RTS
```

There are a few coding tricks that F. R. has to keep in mind to do this translation. First, two-byte addresses are coded "backwards" – that is, hex 0300 is coded as 00 03 and hex FFD2 is coded as D2 FF. Secondly, Branches are coded as a relative offset, so that D0 02 may be read as "if not equal, hop over the next two bytes." A relative branch value of hex EF (see BCC YLOOP) causes the program to branch back 17 locations from the start of the following instruction, if the branch condition is satisfied.

The above "hand assembly" can be greatly helped by the use of assemblers or "tiny assemblers" which work out the Op Code values and calculate the branch values.

Now F. R. is ready to put the machine language program into memory. He calls the machine language Monitor with SYS4, and then asks for a memory display from 027a to 0294 with:

```
.M 027A 0294
```

He might get anything. He will go back and type over the memory contents to enter his program. The changed memory map will look like this:

```
.:  027A A2 30 A0 00 E8 E0 3A D0
.:  0282 02 A2 30 8A 20 D2 FF C8
.:  028A CC 00 03 90 EF A9 0D 20
.:  0292 D2 FF 60 .. .. .. .. ..
```

Now that the machine language program is in place, the BASIC program can be written to hook in with it. F. R. returns to BASIC (with .X) and writes:

```
200 DATA 15,10,30,35,28,28,15,0
210 READ V:IF V=0 GOTO 300
220 POKE 768,V
230 SYS 634
270 GOTO210
300 END
```

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Line 220 POKEs the desired value into memory where the machine language program will pick it up. Line 230 calls the machine language program. After the ML program is executed, the BASIC program will resume at line 270.

Try entering the program – both machine language and BASIC – and run it. You'll see the extra speed that machine language gives you.

The program is complete. But it isn't in a form that's very suitable for saving, especially if we want to save to tape. We'll conclude the fearless exploits of F. R. Vescent in the next episode. ©

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Did you ever wonder just how a computer can "pick up" a phone, call another computer, and then hang up? How you can "call" the operator without dialing zero? When you hear the ring, is it really the bell at the other phone making the sound? This month, Mike clears up these and other telephone mysteries.

Telecommunications

Using The Telephone

Michael E. Day
Chief Engineer
Edge Technology
West Linn, OR

An important part of the data communications link is the phone line itself. Since we don't have any direct control over the telephone system, it can present real problems when trying to use it with a computer.

There are three major operations that a computer must be able to perform in order to place a call. The first is the actual placement of the call. The second is the data transfer, the use of the line. Finally, the third operation is the hang-up procedure.

At first glance, these actions might seem rather simple things, but, for a computer, they can be a nightmare. Until recently, the phone company would not even allow you to attach your computer to the phone line. Several court cases, and a recent change in the attitude of the FCC has changed the situation. Now you are allowed to attach your computer (or any other device) to the phone line. The only restrictions are that the attaching device be certified by the FCC and that the phone company be notified.

How One Computer Dials Another

By looking at how a call is normally placed, we can see what a computer must do to place a call.

When nothing is going on, the phone line is in an *idle* condition. In this state, there is approximately 48 volts DC between the red and green wires of the line. (They are referred to as the *tip* and the *ring* of the phone line. Long ago, the red wire was attached to the tip and the green wire was attached to the first ring of the old switchboard plugs.) The 48 volts is provided by the telephone exchange.

To place a call, the first thing you do is remove the handset from the telephone and place it to your ear to wait for the dial tone. The tone indicates that the exchange has recognized that you want to place a call and that you may now begin dialing. From a computer's standpoint, this is a bit of a

... three major operations that a computer must be able to perform in order to place a call.

problem. Essentially, it must rely on a hardware device to do the actual dial tone detection for it: a *dial tone detector*.

There is a little trick we can pull, however. If you have ever observed people placing a call, you will notice that many do not place the handset to their ear and wait for the dial tone before they begin dialing. This is generally because they are unaware of the requirement or have simply developed a routine which bypasses the need to detect the dial tone. This is possible because over 90% of all call requests are answered within two seconds, and 99.9% within five seconds, on most phone exchanges.

So, by simply performing a routine that causes the dialing to begin sometime after two seconds have passed, you can be assured that most of your calls will get through without ever listening for the dial tone. This is easy to do with the computer; a computer is quite good at waiting. We just wait five seconds after simulating picking up the handset and assume that we have the dial tone. This is called *blind dialing*.

Once we have a dial tone (or think we do) the dialing process can begin. On a touch tone style phone, this is done by sending audio tones to the exchange that are coded to represent the numbers we wish to dial. Eight separate tones are used in pairs to represent the various numbers and codes available with the touch tone system. For a computer to dial this way it must have another piece of hardware, a touch tone dialer. However, there is another little trick that can be used to get around this problem, if you are unwilling to pay for the touch tone dialer or you do not have the touch tone system available to you. Use the rotory dial method.

The actual timing of the dialing is critical on a rotary dial style phone. The dialing is accomplished by momentarily "releasing" the phone line and

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then "retaking" it again (as if you were to quickly hang the phone up and pick it back up again).

For each number to be dialed, there is a corresponding number of pulses of this sort to be generated. If a one is to be dialed, only a single release sequence is performed. For a nine, there would be nine release sequences. A zero is represented by ten release sequences. This is why you can sometimes reach the operator by simply jiggling the handset button on the telephone since you are simulating dialing the zero for operator. With few exceptions, all touch tone systems can handle rotary dial operations.

This means that it is possible to forego the touch tone completely and use a relay that we also use to simulate raising the handset for the dial tone.

Timing is critical with rotary dialing: the time of the pulses, and the time between the pulses, must be carefully watched. The release time must be 61 milliseconds, plus or minus three milliseconds, and the time between pulses must be 39 milliseconds, plus or minus three milliseconds. Additionally, the time between digits dialed must be greater than 600 milliseconds, but less than ten seconds. That is, after you sent the pulses to dial a five, you must wait at least 600 milliseconds before starting the pulse sequence for a two. This waiting time is done with the phone "off hook."

Once the dialing has been completed, we then wait for the *ring-back signal.* This is a signal the exchange sends back to you that indicates that it is ringing the phone that you have called. This signal is not the actual ringing of the other phone. It is generated at the exchange for you to hear at your end. The two "rings" are not synchronized and you should not assume that when you hear a ring signal it is occurring at the same time at the other end.

If, after waiting, the phone is not answered, or you get a busy signal, you hang up your own phone which terminates the call. If the ringing sound does not occur, you hang up and try placing the call again – assuming that you did something wrong.

For a computer, all this could be a bit tricky. It must be able to recognize the ringing signal, the various busy signals, dialing errors, or wrong numbers. However, if we concentrate on the ends, not the means, it all comes down to a single, simple action.

A Greatly Simplified Method

If the phone at the other end is busy, doesn't answer, was incorrectly dialed, or the wrong party is reached, we can simply hang up the phone and try again. So all we really need to know is if the computer at the other end has answered. This is one of the functions of a modem. [*The box that attaches to a computer and handles telephone calls for it.*] If the called computer's modem is in the auto-answer mode, then that modem will answer the phone and send a signal back to your modem saying that it has answered. All we have to do after we have dialed the number is sit and wait for the answer signal. If we don't receive an answer after a specified period of time, *for any reason,* we hang up the phone.

To make things even easier, the answer signal that is sent is the same kind of signal that the modem uses to transmit data. All we have to do is wait for our modem to tell us that it is ready to communicate with the distant computer. This bypasses many kinds of error indicators. We don't care *why* we were unable to complete the call, only that we weren't. Once a signal has been received, the computers can communicate until they are ready to hang up.

Normally, when you are finished with a call you tell the party you are talking with that you are done and hang up. Alternatively, they may tell you that they are going to hang up. Sometimes, for various reasons, either of you may hang up without telling the other. And, of course the phone company may hang up for either or both of you due to a malfunction. This, too, could get to be rather complicated for a computer unless we recognize that the end result of any such hang-ups is that the communications link has simply been broken. This means that we are no longer receiving the carrier from the other modem. Therefore, we just observe the carrier detection signal from the modem and, if it goes out, we know we've lost the connection and that we should hang up the phone.

A Computer Picks Up The Phone

Normally, when someone calls we hear the bell. This signal is created by the exchange by rapidly reversing the 48 volt signal that is present on the phone line when it is in the idle state. This reversal occurs about 20 times a second for several seconds, pauses, and then repeats.

The rate of the reversal can vary from exchange to exchange and may be anywhere between 16 times a second to 60 times a second. A modem can detect this signal, (assuming you have an *auto-answer* modem) and can generate its own signal called the *ring indicator.* Depending on the modem, the ring indicator signal may either echo the line reversals of the phone line, or just be on for the duration of the ringing signal.

Once there is a ring indicator signal, it is up to your computer to recognize that the signal is there and to send a *DTR signal* to your modem to tell it to go ahead and answer the call. (The DTR signal could also be left always on, indicating to the modem

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Softlights

By Fred Huntington

THREE-YEAR OLD ATARI COMPUTER USERS BIRTHDAY SALE

Last year, on my daughter Melody's second birthday, we ran a special on Hodge Podge, the great Apple game for preschoolers. This year, we're very happy because Artworks has come out with a version of Hodge Podge for the Atari. My daughter, Melody, has gone ape over it.

Melody doesn't hover around the Apple at home now, just the Atari, because she wants to play Hodge Podge. Whenever she presses a letter, something happens. For example, if she presses "B" a banjo appears and plays music. There is some action for every key on the keyboard.

The graphics are tremendous and the music is great. There is one major flaw, however. Everytime I get near the Atari, I can't play my games. Melody wants to play Hodge Podge.

So, if you have a child between two and six, get them Hodge Podge and be a hero. And, to help celebrate Melody's third birthday, if you say "Happy Birthday, Melody," you can have it for **$15.94** instead of the $19.95 list price. Even at full list price, I believe Hodge Podge to be one of the best bargains available today (We'll even give you the Apple version for $15.99.)

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that the computer will answer any call immediately.)

The modem answers a call by turning on the "off-hook relay" which simulates taking the handset off of the phone hook or cradle. This causes a low impedence load to be placed on the phone line (approximately 600 ohms) and it remains as long as the phone is off-hook. This tells the exchange that you have accepted the call and are ready to answer it. The exchange then begins a supervisory process to stabilize the link and begin any necessary billing.

During all this, the answering modem cannot yet transmit any data; it may disrupt the supervisory process. Most of the new exchanges simply prevent any signals from being transferred during this time, but some of the older exchanges don't have this protection and signals could get disrupted. This could cause anything from the exchange hanging up on you to its billing you for a call you didn't make. This time period of disallowed transmission lasts a maximum of two seconds. Once this time period has passed, the computers can communicate normally. If you later lose the carrier signal, you should assume that the other end has hung up their phone and hang up yours. ©

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RENUMBER: the SM-KIT can renumber all or any part of a program. The selective renumbering allows you to move blocks of code within your program.
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If you have a SuperPET, this article will show you how to use all 96K from Commodore BASIC.

Run 96K Programs On The SuperPet

Paul Donato
Sudbury, Ontario

The SuperPet has an additional 64K of memory: 16 4K banks addressed at memory location 9000 hex. POKEing a decimal number from 0 to 15 into decimal location 61436 will cause the appropriate bank to be switched in. Full use of this memory is possible when the SuperPet is used in the Commodore BASIC mode. By having a main program in the regular 32K of PET memory one can access up to 16 4K modules or BASIC routines which are preloaded into the additional 4K memory banks. To do this the main program must do basically three things:

1. it must POKE into location 61436 the number of the desired bank.
2. it should then POKE 41,144. This causes the start-of-BASIC pointer to point to 9000 hex.
3. finally, the program should execute a GOTO, directing program execution to a line number within the desired module.

Ideally, the preceding steps should all be executed within the same program line. All program variables still reside in the regular 32K of memory and can therefore be shared by the main program and all of the modules. All string variables should be initialized by the main program. This will insure that no string pointers will point beyond $8000 hex.

To return to the main program from a module, simply POKE 41,4 and GOTO to a line in the main program. Again, these commands should be executed on the same program line in the module program.

Loading Programs In The 4K Banks

The BASIC program modules are written, saved, and loaded in the regular 32K PET memory normally. To transfer the module into the 4K bank, a small machine code program residing at $7FB0 hex can be used. This program must first be loaded into memory using the PET monitor before the modules are loaded in. Once this is done the appropriate module is called into memory using a load command, the appropriate bank number is then POKEd into location 61436 and the transfer is executed with the command SYS32688. Once all of the required modules are loaded in this way, the system is reset with the command SYS64790 and the main program is then LOADed in and RUN.

Note: Trying to see which bank is switched in by PEEKing location 61436 is not possible because the banks are latched in during the POKE command and checking this location after this gives a meaningless number.

This is a listing of the machine code program which transfers BASIC program module from main memory in the PET to location 9000 hex and makes it executable.

```
7FB0  A9 00     LDA  #$00     ;SET UP LOW ADDRESS
                              POINTERS
7FB2  85 00     STA  $00      ;HEX 0400
7FB4  A9 04     LDA  #$04
7FB6  85 01     STA  $01
7FB8  A9 00     LDA  #$00     ;SET UP POINTERS TO HIGH
7FBA  85 02     STA  $02      ;ADDRESS HEX 9000
7FBC  A9 90     LDA  #$90
7FBE  85 03     STA  $03
7FC0  A2 0F     LDX  #$0F     ;NO. OF 256 BYTE BLOCKS TO
7FC2  A0 00     LDY  #$00     ;TRANSFER-1
7FC4  B1 00     LDA  ($00),Y  ;DO THE ACTUAL TRANSFER
7FC6  91 02     STA  ($02),Y
7FC8  88        DEY
7FC9  D0 F9     BNE  $7FC4    ;FINISH THE BLOCK (256
                              BYTES)
7FCB  E6 01     INC  $01      ;MOVE TO NEXT BLOCK
7FCD  E6 03     INC  $03
7FCF  CA        DEX
7FD0  30 03     BMI  $7FD5    ;BRANCH IF LAST BLOCK
                              DONE
7FD2  4C C2 7F  JMP  $7FC2    ;IF NOT CONTINUE TRANSFER
7FD5  A9 90     LDA  #$90     ;CHANGE START OF BASIC
                              POINTER
7FD7  85 29     STA  $29      ;TO 9000 HEX
7FD9  20 B6 B4  JSR  $B4B6    ;RELINK THE BASIC TEXT AT
                              9000 HEX
7FDC  A9 04     LDA  #$04     ;RESTORE START OF BASIC
                              TO 0400
7FDE  85 29     STA  $29
7FF0  60        RTS           ;RETURN
```

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Atari Drives And Disk Operating Systems

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It's now the tenth time that you've waited five minutes for your program to load from tape on your Atari and you have begun to wonder if there isn't a better way. Even though the Atari tape recorder seems to load flawlessly, the waiting time becomes a nuisance, not to mention the fact that you must be careful to set the recorder to just the right spot on the tape in order to give the computer just the right length of silence before the data comes streaming in.

And how many times have you lost a program during development because you didn't want to "waste" the time required to save it on tape? The answer, of course, is to get a floppy disk drive, in particular the Atari 810. There are not yet any non-Atari disk drives available for your computer. It isn't an easy decision to make when the disk drive costs more than half the cost of the computer. Let's try to cover the things that you need to know in order to make an intelligent purchase and also include an analysis of the two disk operating systems (DOS) that Atari has released: the original DOS I and the updated and improved DOS II.

Care And Feeding Of The 810

The 810 disk drive comes in a case measuring 4.5 H x 9.5W x 12D, attractively designed to match your computer. It comes with a separate power supply, just like the one that runs the computer. (A mild complaint: If each of the peripherals comes with one of these power supplies, where do we put them all?) With the 810's two input/output connectors, it is a simple matter to interconnect whatever items you have feeding into or out of your computer. There are two slide switches in the back which you set to tell the computer which drive it is addressing (#1-#14). With only one drive (and that covers nearly all of us) you set it for #1.

You must always power up the drive before the computer or else the computer will not be aware that there is a disk drive on the line. You also want to be sure that you do not have a diskette inserted when you power up, as this is an easy way to destroy any information on it. Keep in mind that the drive unit must be placed a minimum of 12 inches from the TV or telephone or anything else that generates a magnetic field. This is another easy way to wipe out a diskette.

As for diskettes, you can use soft or hard sectored ones because the Atari doesn't use the timing holes at all, but rather writes the timing information on the disk during formatting. You will quickly learn the do's and don'ts of physically handling diskettes. Be sure to use only felt-tipped pens when writing on labels attached to the diskettes. Failure to do this can ruin a diskette. Each side of a diskette will store about 92K [*92 kilobytes, or 92 x 1024 bytes*] which is roughly equivalent to four C-10 cassette tapes.

The power of the disk drive comes into play in the rate of reading and writing data and programs from and to the disk (6000 bits per second) and the identification of each file on a diskette by name. To run a program you simply type RUN "D1:TESTPROG.EXT", where D1 is the drive number, TESTPROG is the name of the program (up to eight characters, beginning with an alphanumeric, containing no spaces and using any letters or numbers) and .EXT is an extension that can be used to identify programs by type (i.e., .BAS for BASIC, .DAT for DATA, etc.). The DOS (much more on that later) searches the diskette for the program, loads it, and then begins to execute it. All the other Atari I/O commands are also available (SAVE, LIST, ENTER, PUT, GET, LOAD, PRINT, INPUT, etc.)

The time required to SAVE a program to diskette is longer than the time required to LOAD the program from the diskette because, during SAVE, the computer checks to be sure that the data has been correctly transferred. You can override this "write with verify" feature if you wish. For us former tape recorder users, the transfer rate is still so fast that there is no longer any time to go and get a snack while a program LOADs or SAVEs.

As the Atari software field matures, more and more programs are appearing only on diskettes, either because of length or because they need to make frequent access to disk stored data during execution. I have seen advertisements for Adventure-type programs that use up to six diskettes and database programs that are only practical on disk. There is even a magazine for the Atari that appears only on diskette. It has been reported that 90% of all Apple owners have disk drives. As a final argument, for those who are still holding onto their money, the purchase of a disk drive gives you the opportunity to turn your Cadillac of personal computers into a Ferrari. Enough said?

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Atari DOS I Versus DOS II, Or Vas Ist DOS?

Just as the computer requires an operating system in order to function, so, too, does the disk drive. The disk operating system (DOS) comes recorded on a diskette and is the first thing that the computer looks for when it is powered up. I will be concentrating on DOS II in this article, referring to DOS I when it seems appropriate to point out the improvements that DOS II brought about.

DOS II consists of three files; DOS.SYS, DUP.SYS, and AUTORUN.SYS. DOS.SYS boots when the computer is turned on. You can then direct all BASIC commands to the disk drive. DUP.SYS contains the utilities to run the DOS menu and is called from BASIC by typing DOS. AUTORUN.SYS is intended to boot automatically after DOS.SYS and can be modified to perform any function that the user feels should automatically come on line. It currently looks for the 850 Interface Module handler and, if it finds it, the computer loads it. This corrects one of the flaws in DOS I. Any file may be named AUTORUN.SYS, thus booting automatically on initialization.

Speaking of flaws, DOS I has several, all of which are corrected in DOS II. Those with DOS I may be unaware of some of these flaws (and therefore blame themselves or their computer for some odd happenings), so here is a list of the more significant problems:

1. The DUPLICATE DISC command occasionally has trouble with the first eight sectors and, if DOS is in these sectors, you will get a diskette that will not boot.

2. AUTO.SYS loads files, but won't execute them.

3. COPY FILE and DUPLICATE FILE commands allow illegal use of wildcards and this causes problems.

4. If FORMATting finds bad sectors, the user is not informed.

5. In some instances, full length filenames are not accepted.

6. Sectors on diskettes are sometimes taken out of user availability when they shouldn't be.

DOS II boots in seven seconds. You are then in BASIC and can use all the I/O commands to communicate with the disk drive. In order to use the DOS menu commands, you must type DOS. After about nine seconds you get a menu [*a list of choices*]. The reason for this method is that then it is unnecessary to use active computer memory to hold the menu functions unless they are specifically needed.

DOS I has the menu automatically boot and this consumes a considerable amount of memory (about 6K) which is then unavailable for program storage unless you dump DOS. DOS II could potentially get you in trouble when you called for the menu, since it requires a portion of memory that you might also be using and, hence, you would lose your program. This has been neatly taken care of by allowing the user to create a MEM.SAV file on his diskette. MEM.SAV is a place for the computer to put that part of memory that DUP.SYS needs for the menu. Thus, the computer automatically saves your program before going to the menu and restores your program after you release the menu. The penalty here is time, since MEM.SAV takes about 30 seconds to operate. The alternative is to SAVE any resident programs before calling the menu and not use MEM.SAV at all. There is a tradeoff here since MEM.SAV provides a nice degree of protection. Anyone who has lost a program after hours of typing will appreciate this feature.

The rest of the menu commands relate to operations on the diskette-stored files, and their names are pretty much self-explanatory. Their implementation is well described in the instruction manual. An area of major concern is the compatibility of DOS I and DOS II formatted diskettes. All diskettes must be formatted before they can be used and the DOS I and DOS II formatting is not the same. Using DOS I on DOS II formatted diskettes will destroy files, whereas using DOS II on DOS I formatted diskettes will either work or else give an error message. Therefore, the rule of thumb is to always use DOS II, especially if you are not sure of the diskette formatting.

There is a bug in DOS II for those who have an 850 Interface Module with something attached to a serial port on it. The COPY command, which allows you to copy a file disk-to-disk, disk-to printer, or disk-to-whatever, does not allow you to copy to the serial port. This is because the Interface Module handler, which boots at the same time as DOS, occupies the same space in memory as DOS and, thus, gets garbled. The result of a COPY to the serial port is that the computer goes off to never-never-land and you have to turn it off and reboot to regain control (losing any programs in memory). As I write this, Atari is working on the problem of relocating the Interface Module handler out of harm's way.

The Dark Side Of The Force

The 810 Disk Drive and/or DOS II have some "sometimes" bugs. There are occasions when disks from my drive will not run on other drives and vice versa. This was traced to speed variations in the drives. In fact, Atari redesigned their disk drive to incorporate an external data separator. This has effectively cleared up this problem. For those with older disk drives, Atari will be offering to upgrade those drives.

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An alternative is a do-it-yourself installation that has been promoted by Atari Users' Groups and which is easy to do. Also available from either of these two sources is a fast formatting chip modification that speeds up the read-write operations. On the horizon are double density and dual disk drives from other suppliers. The latest Atari computers being sold also have a modified operating system board in them. The most significant change when using these will be the elimination of the annoying pauses that occur during communication with the disk drive.

[*For a third alternative to disk speed adjustment, see "Getting Your Atari Disk Drive Up To Speed,"* **COMPUTE!**, *May, 1982, #24.*]

Atari Disk Menu With DOS II

The "Atari Disk Menu" program in **COMPUTE!**, January, 1981, #8, is a very useful program which enables the user to access programs on disk without having to remember their names or their exact spelling. This program will not, however, run on DOS II. However, it is easy to fix the program *and* add the feature of printing out the free sectors available on the disk.

With DOS II there is a difference in format for the "free sectors file" between DOS I and DOS II. In DOS I this file is simply a number indicating the sectors that are unused, while in DOS II this file has the number of sectors available plus the phrase "free sectors." Therefore, when line 130 tests for the length of the file (looking for <5 if the file is the DOS I "free sectors" file) it fails in DOS II (which has a longer file length) and gives an "end of file" error and stops.

A consideration of the file format makes a fix very easy. All program name files consist of two spaces plus a file name of up to eight characters plus an optional decimal point and three character extender. For example, a file name may be TEST-RUN4.BAS where the length of the file name may be less than this. The filename that holds the free sector information, however, is made up of the number of free sectors plus the phrase "free sectors." The key is the absence of the leading spaces. Therefore, if line 130 becomes

```
130 IF FILE$(2,2) <> " " THEN PRINT FILE$:
    GOTO 500
```

When the program encounters the free sectors file it will print it out, thus giving the number of sectors, and go on to ask which program you wish to run. FILE$(2,2) is used rather than (1,1) because if the file is locked, FILE$(1,1) will have a "*" in it. This small change makes a useful program even more useful. ©

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A Simple 2716 EPROM Programmer For The PET

Phil Gentile
Belton, MO

PET owners who are involved in machine language programming usually collect a number of subroutines that aid in the operation of the PET. These subroutines may consist of repeat key functions, screen print programs, or other helpful machine language routines which may be written by the user or found in magazines.

These subroutines must all be loaded into RAM before they can be used. The second cassette buffer, or a portion of high RAM, is usually the choice.

Now, for just a few dollars and a little time, you may put all of these programs in EPROM [*Erasable, Programmable ROM. These chips are a compromise between RAM and ROM – like ROM they will hold information with the power off. Like RAM, you can reprogram them (by erasing them using special techniques).*] EPROM is a better location for these programs for two reasons. First, if the programs are in EPROM, they don't have to be loaded; the programs are there when you power up. Second, in EPROM, the programs don't take up any of your precious RAM space.

There are a number of EPROM programmers on the market, ranging in price from many hundreds down to fifty or sixty dollars. They all do basically the same thing, the expensive ones are just fancier and more versatile in the types of EPROMs which they can program.

This EPROM programmer, as it is presented here, can only program a 2716, or 2716 compatible EPROM. The 2716 is a 2K byte EPROM. I have found 2K to be more than enough space to hold all of the machine language programs that I need, including the DOS Wedge. If you find that you need more space, the programmer and the accompanying software may be easily modified to program larger EPROMs. You may do this by connecting the unused address lines on IC-2, and modifying the M/L "program pulse" subroutine to satisfy the requirements of the EPROM you select.

The EPROM programmer is very simple. It consists of three 74164, eight bit shift registers, one 24 volt regulator, a couple of switches and three 9 volt batteries. One shift register holds the data shifted out by the PET. The remaining two shift registers hold the EPROM addresses as they are shifted out. The 24 volt regulator reduces the voltage from the series wired batteries down to the 24 volts necessary to program the 2716 EPROM. The PET, using the accompanying software and the PET's user port, supplies all of the necessary data, addresses, and signals to program the EPROM. The five volt VCC supply can also be taken from the PET if you use low power (ls) type IC's. This circuit, using "ls" IC's, will draw approximately 100 Ma. This small amount of current may safely be drawn from pin B of the second cassette edge connector (J3).

You may use any type of construction you wish to build the circuit. Wire wound, PC board, or plug-in type breadboard are all OK. If you wish to save the considerable expense of a zero force socket for the EPROM (about $9.00), then I would recommend the plug-in type breadboard construction. The EPROM can be easily inserted and removed from this type of board, reducing the chance of damage to the EPROM pins.

The 74164 shift registers are common IC's and can be purchased in most electronics supply stores. The 24 volt regulator is also a common component. Be sure to get the positive rather than the negative type regulator. The switches are miniature SPDT. The batteries used are standard 9 volt transistor type. I used the heavy-duty versions.

There are only a few things to watch out for. Be sure that the regulator is wired properly. The allowable voltage range on pin 21 of the 2716 EPROM is 24 to 26 volts. Be careful when handling the EPROM. Static electricity on the pins may destroy it. Last, but most important, *always* follow the proper sequence when applying the voltages to the EPROM. The 5 volt VCC supply *must* be turned on first, followed by the 24 volt VPP supply. When turning the voltages off you must reverse this procedure. If you follow the instructions as they are given by the program, you will have no problem. If you don't, you may destroy your EPROM.

Software Control

The software to control the EPROM programmer consists of a small BASIC program and three small machine language subroutine modules that reside in RAM at 4100 through 4276.

The BASIC program is used primarily to interface with the user. It issues instructions for the operation of the EPROM programmer and

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accepts user information on where the machine language code (to be programmed into the EPROM) is located in the PET's memory. It also asks the user for the EPROM starting address. The BASIC program then gets the selected code from the PET's memory and passes it to the machine language modules. They, in turn, send the code to the EPROM programmer.

The first M/L module, located at 4104, sends the data from the PET's memory serially out over the PA-0 line. As it sends this data out over PA-0, it also sends a shift (clock) pulse out on the PA-1 line which is connected to the data register, IC-1. This clock pulse loads the data on PA-0 into the data register.

Next, the BASIC program jumps to the M/L routine, located at 4184, which shifts out the EPROM address. This routine sends the address out on the PA-0 line also, but it sends the shift signal out over the PA-2 line which is only connected to the address register (IC-2 & IC-3). Since the data register is not connected to the PA-2 line, the information stored in this register is not affected when the EPROM address information is shifted into the address register.

Finally, after all of the data and EPROM address information is safely stored in the registers, the machine language module located at 4107 sends a 50 milisecond "program" pulse to the 2716 EPROM telling it to store the byte of data in the selected EPROM address. This "program" signal is sent out over the PA-3 line. The BASIC program then begins the cycle all over again for the data contained in the next core location. This continues until all of the PET memory addresses, requested by the user, have been programmed into the EPROM. The BASIC and machine language programs occupy RAM locations 1025 through 4276. You may place your EPROM code anywhere else in RAM that you wish.

To use this EPROM programmer you must first, of course, have some machine language code that you want to put in EPROM. The example I will use here is a procedure for putting Commodore's DOS Wedge in EPROM. The machine language code for the DOS Wedge is completely relocatable. After the Wedge has been loaded from disk and executed, the Wedge M/L code resides in the PET's top 359 bytes of RAM. To find out exactly where this code has been stored, go to the machine language monitor and display locations $0070 thru $0072. The program that loads the Wedge, stuffs a jump to the address of the Wedge into these locations. If the Wedge has been loaded, you should see a "4C" in location $0070, followed by the low-byte, hi-byte address of the Wedge. On my 16K PET, this code reads, "4C 99 3E". This translates into the decimal location, 16025.

Now we know where the code for the DOS Wedge is in core, so let's put it into EPROM. First hook the EPROM programmer up to the PET's user port. Do not put the EPROM in its socket yet. Now hook up both the 5 volt and the 24 volt power supplies. Make sure that both of the switches on the programmer are turned off. Put the EPROM into it's socket on the programmer and load the EPROM programming software. The program will tell you to first turn on the 5 volt, and then the 24 volt power supplies. Do this in the sequence described.

The program will next ask you for the starting RAM address of the machine language code that you wish to put into the EPROM. In this case, this is the address that we found in locations $0071 and $0072. The low order byte of the address is in $0071, the high order byte in $0072. Convert this address to its decimal value, in the case of a 16K PET, 16025, and enter it. The next address that the program asks for is the ending address of the code. The DOS Wedge is 359 bytes long, so your ending address is 16383 and press return. Next, the program asks where you want the code to start in the EPROM. If you are using a new EPROM, without any code previously programmed into it, you will probably want to start in location zero. Enter the EPROM starting address and press RETURN. The machine language code for the DOS Wedge is now being programmed into your EPROM.

After it has finished programming the EPROM (approx. 1.5 minutes), the program will give you the last EPROM address programmed. If you started at EPROM address zero, this address will be 358. Write this address somewhere for future reference. Turn the power switches off in the order given by the program. Leave the EPROM in the socket for now.

Now that we have the Wedge in EPROM, we must tell the PET where we are going to put it. We'll use the same method that the Wedge loader uses. For the sake of this demonstration, we will assume that the EPROM is going to be placed in the PET's empty EPROM slot at address $9000. Go to the machine language monitor and display locations $03E4 through $03F0. Enter the following code starting in $03EF, "A9 4C 85 70 A9 00 85 71 A9 90 85 72 60." This code, when executed, will load a jump to location $9000 into locations $0070 thru 0072. Get out of the Monitor and execute the EPROM programmer program again. This time your starting RAM address will be the starting address of our little loader patch, 996 (hex 03E4). The ending RAM address will be 1008 (hex 03F0). The EPROM starting address will be one more

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than the EPROM ending address that we saved after our last run (358 + 1 = 359). When the program finishes, the EPROM contains everything we need to run the DOS Wedge from EPROM.

Turn the PET off and install the programmed EPROM in the EPROM socket at $9000. Turn the PET back on and jump to the EPROM starting address of our little loader program, SYS(37223), ($9000 = 36864 + 359 = 37223). You should now be able to execute any DOS Wedge command from the EPROM.

I don't know how long the 9 volt batteries will last. I have programmed a couple of EPROMs, and have done a lot of testing using the original set, they still seem to have a lot left.

With the software written partly in BASIC and partly in machine language this system will program approximately three bytes per second. If you wish to make it operate faster, the software could be written entirely in machine language.

If you are careful to follow the schematic, and in entering the program code, you will have an EPROM programmer costing around fifteen or twenty dollars. That is a lot cheaper than buying one. In addition, there is a lot more fun, satisfaction, and knowledge to be gained by building your own.

```
170 ** LOAD ML PROGRAM MODULES ***
180 POKE53,16:POKE4102,0:POKE4103,0
190 READX,Y
200 FORI=XTOY
210 READ Z
220 POKEI,Z
230 NEXTI
240 :
250 POKE59459,15:POKE59471,0
260 PRINT"{03 DOWN}TURN ON THE 5 VOLT POWER
     SUPPLY.
270 PRINT"AND PRESS RETURN.
280 PRINT
290 GETA$:IFA$=""THEN290
300 PRINT"NOW TURN ON THE 24 VOLT POWER SUP
    PLY
310 PRINT"AND PRESS RETURN.
320 PRINT
330 GETA$:IFA$=""THEN330
340 INPUT"STARTING RAM ADDRESS (DEC.)";R1ST

350 INPUT"ENDING RAM ADDRESS (DEC.)";R2E
360 PRINT:INPUT"STARTING EPROM ADDRESS (DEC
    .)";R3ST
370 IFR3 > 2047 THEN PRINT:PRINTR3" EXCEEDS
     2716 EPROM SIZE.":PRINT:GOTO360
380 N=R3: GOSUB740
390 HI$=LEFT$(N$,2):LO$=RIGHT$(N$,2)
400 N$="00"+HI$:GOSUB910:POKE4102,N
410 N$="00"+LO$:GOSUB910:POKE4103,N
420 :
430 REM *** SHIFT THE DATA OUT ***
440 :
450 PRINT"{CLEAR}PROGRAMMING FROM RAM LOCAT
    ION:":PRINT
460 FORK=R1TOR2
470 PRINTK
480 A=PEEK(K)
490 POKE 4104,A
500 SYS(4152)
510 :
520 REM *** SHIFT ADDRESS OUT
530 :
540 SYS (4184)
550 :
560 REM *** SEND OUT THE M/L PROGRAM PULSE
    ***
570 :
580 SYS (4107)
590 :
600 NEXTK
610 PRINT
620 HI=PEEK (4102)
630 LO=PEEK (4103)
640 N=HI:GOSUB 740:HI$=RIGHT$(N$,2)
650 N=LO:GOSUB 740:LO$=RIGHT$(N$,2)
660 N$=HI$+LO$:GOSUB 910
670 PRINT "LAST EPROM ADDRESS WAS "N-1
680 PRINT:PRINT "TURN OFF THE 24 VOLT SUPPL
    Y
690 PRINT"AND THE 5 VOLT SUPPLY, IN THAT OR
    DER!"
700 PRINT"
710 END
720 :
730 REM ** DECIMAL TO HEX **
740 A=N:X=0
750 A=A-4096
760 IF A<0 THEN A=A+4096:Z=X:GOSUB970:E$=X$
    :GOTO 780
770 X=X+1:GOTO 750
780 B=A:X=0
790 B=B-256
800 IF B<0 THEN B=B+256:Z=X:GOSUB970:F$=X$:
    GOTO 820
810 X=X+1:GOTO790
820 C=B:X=0
830 C=C-16
840 IF C<0 THEN C=C+16:Z=X:GOSUB970:G$=X$:G
    OTO860
850 X=X+1:GOTO 830
860 D=C:Z=D:GOSUB970:H$=X$
870 N$=E$+F$+G$+H$
880 RETURN
890 :
900 REM ** HEX TO DECIMAL **
910 X$=RIGHT$(N$,1):GOSUB1000:D=Z
920 X$=MID$(N$,3,1):GOSUB1000:C=Z*16
930 X$=MID$(N$,2,1):GOSUB1000:B=Z*256
940 X$=LEFT$(N$,1):GOSUB1000:A=Z*4096
950 N=A+B+C+D
960 RETURN
970 IF Z<10 THEN X$=STR$(Z):X$=RIGHT$(X$,1)
    :RETURN
980 X$=CHR$(Z+55):RETURN
990 :
1000 IF X$<"A" THEN Z=VAL(X$):RETURN
1010 IF X$=" " THEN Z=0:RETURN
1020 Z=(ASC(X$)-55):RETURN
1030 :
1040 REM *** DATA STATEMENTS FOR M/L CODE **
     *
1050 DATA 4100,4276
1060 DATA 169,5,141,248,3,32,169,169,5,141,9
     ,16,32,29,16,173
1070 DATA 9,16,201,0,240,2,208,244,96,169,8,
     160,144,141,79,232
1080 DATA 162,48,202,208,253,136,208,248,169
     ,0,141,79,232,206,9,16
1090 DATA 96,1,2,4,162,8,173,8,16,45,53,16,1
     41,79,232,13
```

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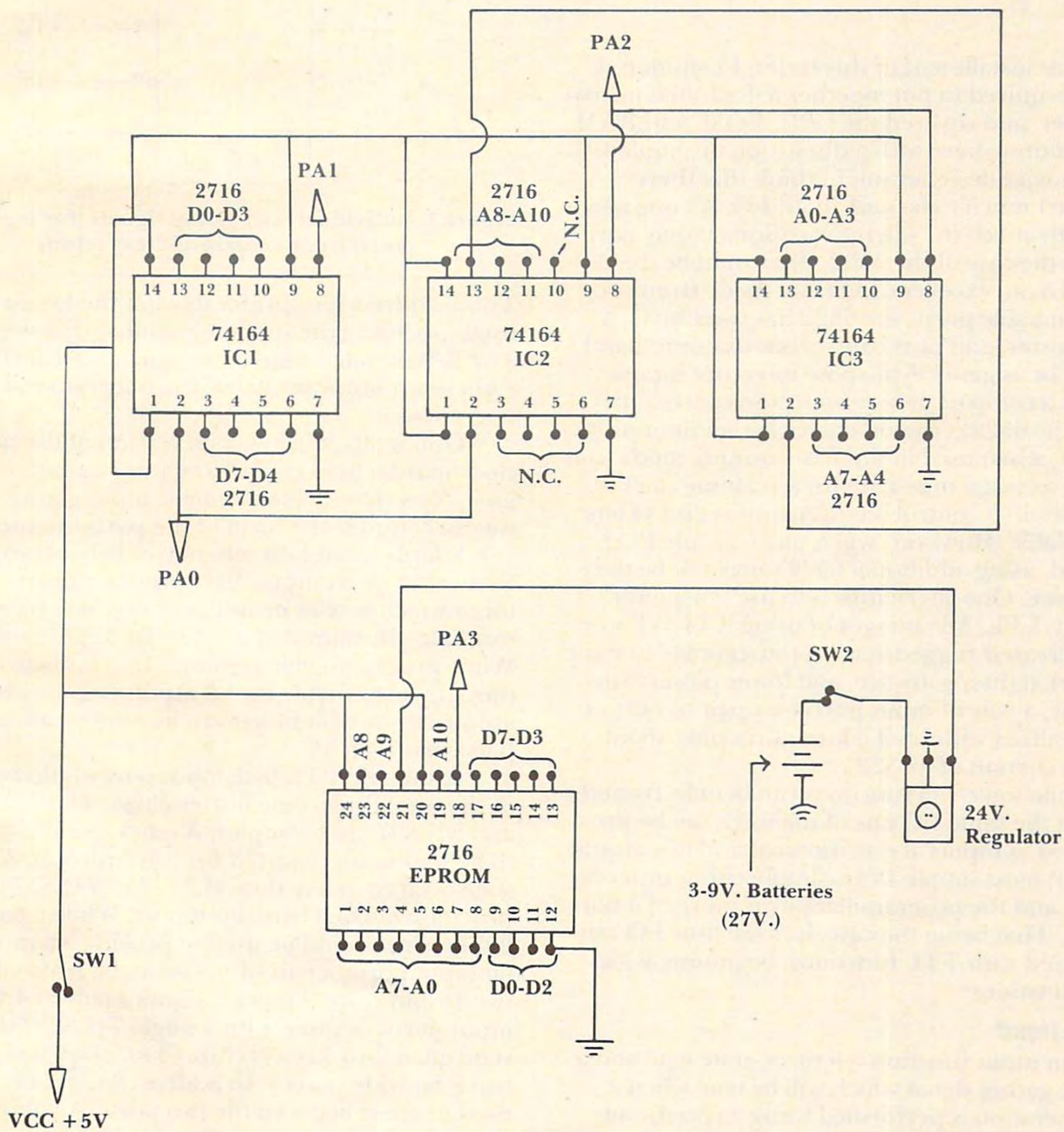
```
1100 DATA  54,16,141,79,232,169,0,141,79,232
    ,202,240,6,78,8,16
1110 DATA 76,58,16,96,173,6,16,141,4,16,173,
    7,16,141,5,16
1120 DATA162,8,173,7,16,45,53,16,141,79,232,
    13,55,16,141,79
1130 DATA 232,169,0,141,79,232,202,240,6,78,
    7,16,76,102,16,162
1140 DATA8,173,6,16,45,53,16,141,79,232,13,5
    5,16,141,79,232
1150 DATA169,0,141,79,232,202,240,6,78,6,16,
    76,133,16,24,216
1160 DATA173,5,16,105,1,141,7,16,173,4,16,10
    5,0,141,6,16
1170 DATA 96
```

COMPUTE!
The Resource.



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The previous article in this series appeared in **COMPUTE!**, *November, 1981, #18, pg. 160.*

Nuts And Volts

Build Your Own Controllers

Eugene M. Zumchak
Buffalo, NY

In the last installment of this series, I considered what is required to put together a dedicated microcontroller, and covered the CPU, ROM, and RAM. I will continue here with a discussion of simple I/O.

A novice designer might think that there really isn't much to be said about I/O. All one needs to do is to attach the microprocessor's family port chip. In the case of the 6502, this would be the 6522 VIA, an excellent I/O chip. Aside from two programmable ports, the 6522 has two timers, a shift register, and port control bits usable in handshaking or as general-purpose interrupt inputs.

For a compact general-purpose controller board, the 6522 is a good choice for minimum I/O. Timer 1, when used in the free-running mode, can provide a crystal time-base for a realtime clock. And including control bits, as many as 20 I/O bits are available. However, when more simple I/O is required, using additional 6522's may not be the best choice. One alternative is to use low-power Schottky TTL. Advantages of using TTL is lower cost, increased ruggedness (not susceptible to static damage), tighter software, and lower power. Surprisingly, a pair of input ports or a pair of output ports realized with LS-TTL requires only about half the current of a 6522.

While some I/O functions can benefit from the fact that the same I/O bits of the 6522 can be programmed as inputs at one moment and as outputs the next, most simple I/O is simply either input or output, and the programmability is more of a nonfeature. That being the case, let's see how I/O can be realized with TTL functions, beginning with input functions.

Simple Input

The unit input function is a three-state gate and a suitable gating signal which will be true when a read operation is performed using a specific address. Assume that our input functions will use a coarse address select with base address $2000. (This could be a 1K, a 2K, a 4K, or even an 8K select). A single 74LS138 3-to-8 decoder can be used to further decode this coarse select into eight individual gating signals as shown in Figure 1.

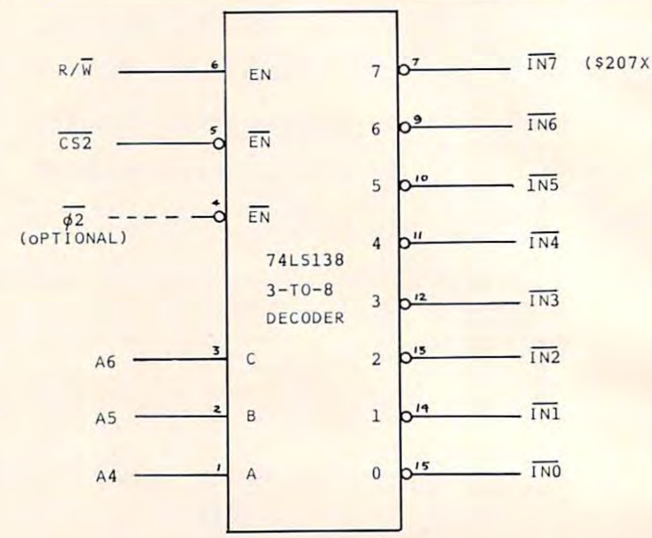

Figure 1. Individual read gating signals (for input ports) from a coarse address select.

Three address bits, preferably not the lowest, are used to achieve the subdivision into eight selects. The R/W signal is used as an enable so that the eight select outputs can be true only for read operations.

Optionally, the low-true version of the phase-2 clock may be used to restrict gating signals to ϕ2 time. Now that we have suitable input gating signals we can consider the form of the ports themselves.

Simple input falls into one of two categories. Byte input or bit input. Byte input, of course, is input which is read in and used in a byte form; for example, the output of an parallel ASCII keyboard. While programmable ports are fine for byte inputs, they are less suitable for bit inputs (inputs which are strictly one-bit functions, like the condition of a particular switch).

A suitable TTL byte input port would be any of the octal three-state buffer chips. The 74LS244 and 81LS97 are examples, A quick count will show that 20 pins are required for this function. A three-state octal latch like the 74LS373 or 74LS374 can provide a latched byte input port. While a pair of 20-pin chips could be used to provide a pair of 8-bit input ports, a pair of ports can be realized with two 16-pin chips. Figure 2 shows a pair of 4-bit input ports, realized with a single 74LS257 three-state quad 2-to-1 select chip. (Two chips will give two 8-bit wide ports.) An address bit, usually A0, is used to select between the two ports. A pair of these chips takes typically 20 mA, much less than a pair of ports from a 6522.

Most designers use byte-style input ports for

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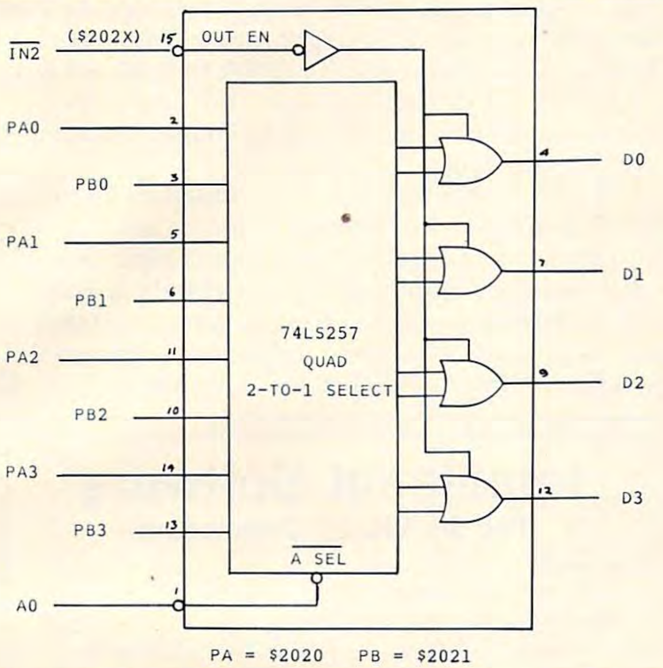

Figure 2. Two 4-bit input ports from a three-state quad 2-to-1 select gate.

bit input functions. A particular bit in a port can be isolated for making a decision by loading in the port data, ANDing with an appropriate mask, and branching based on the zero flag. However, an 8-bit input port can be realized with a 16-pin 74LS251, a three-state, 8-to-1 select function. The single output bit is brought in on data bit D7. Now any of the eight bits may be individually addressed and tested. Such a bit-addressable port is shown in

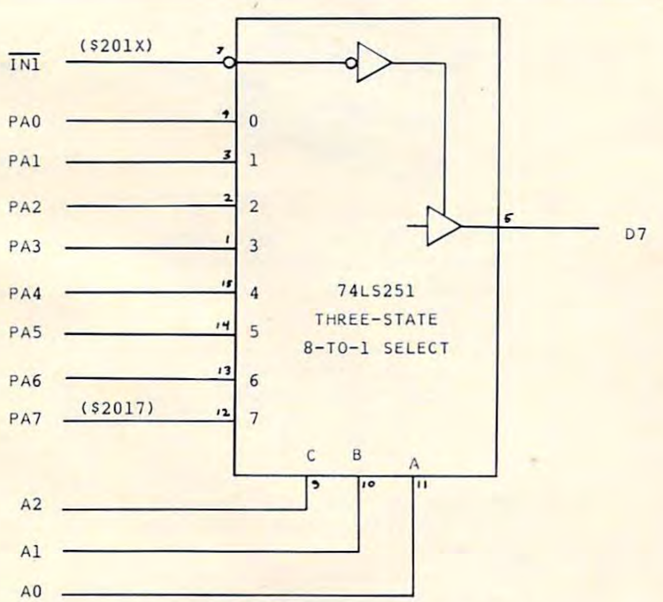

Figure 3. Eight-bit input port with individually addressable bits.

Figure 3. In particular, any bit can be tested with a BIT instruction to the bit address, followed by a branch based on the sign flag. Thus, input bit tests take only two, not three, instructions, and do not change the A register. Since each individual bit in the port has its own unique address, each bit function in software will have its own unique label, making the software somewhat more readable. That is far superior to calling a byte of eight switches *SWITCHES*.

Simple Output

Like simple input, simple output can be bit output and byte output, but also pulse output. As with inputs, the first job is to provide suitable control signals for our output functions. A single 3-to-8 decoder chip can provide eight individual write strobing signals from a coarse address select. (Figure 4.)

In this case, the ϕ2 clock signal is not optional since write strobing action is accomplished with

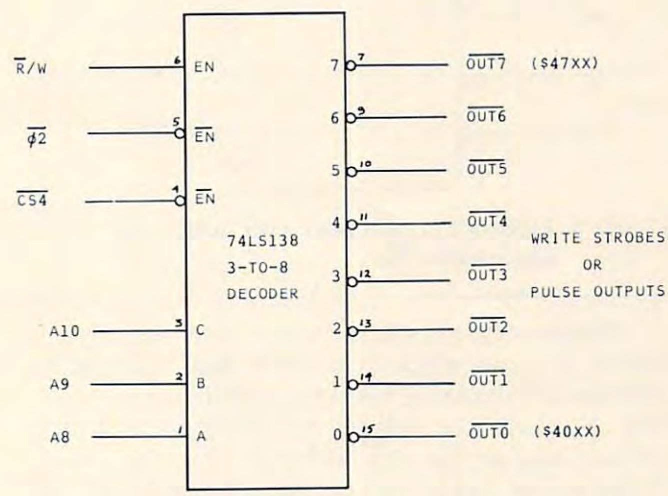

Figure 4. Individual write strobe signals for output ports from a coarse address select.

this signal in 6502 timing. The application of the low-true version of the ϕ2 delay in the individual outputs and an acceptable amount of write hold-time loss. (See the early Nuts & Volts columns on read/write timing).

Byte style output ports can simply be any of the numerous octal latches in 20-pin packages. While the board space requirement for a pair of such ports is about the same as for a 6522, the power is somewhat less. As with input functions, most designers use byte-style output ports to achieve single bit outputs. The differences are resolved with software. To turn off (or on) a particular bit, without changing other bits in a port, the output port (or status) is loaded, an appropriate AND (or OR) mask used, and the altered data is written to

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the port. This takes three instructions and eight bytes. However, if a port with individually addressable bits is used, any arbitrary bit can be turned on or off with a single three byte instruction, and without changing the accumulator. The port itself is shown in Figure 5, and uses the not-well-known 74LS259 addressable latch chip. This chip has three address lines to select one of eight output bits. A single data line is used to apply the one or zero to set or clear the selected bit.

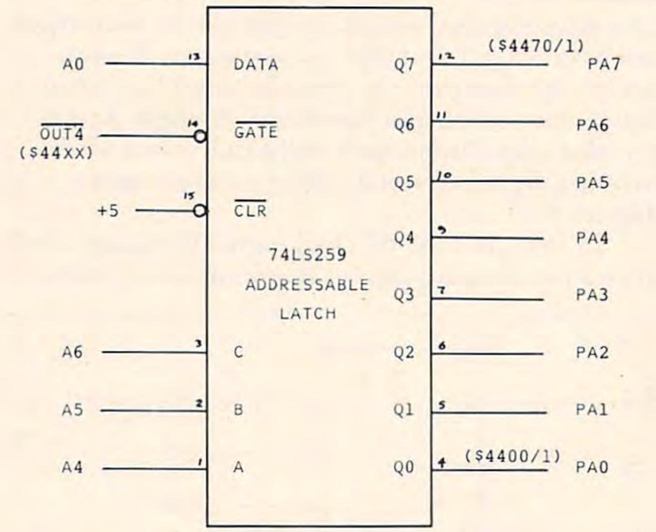

Figure 5. Eight-bit output port with individually addressable bits.

There is no reason, however, why this data bit cannot be applied via the address bits. Specifically, address bit A0 can be used to provide set or reset data. A selected bit will be reset for even addresses (A0 = 0) and set for odd addresses. For the wiring shown in the figure, writing to address $4400 will clear bit zero. Writing to $4451 will set bit five. That is, the least hex digit is either zero or one, and the next-to-least hex digit is used to select one of eight bits. Thus, a STA $4461 will set bit six where the contents of A is totally irrelevant. That is, it is unnecessary to load A (or X or Y) before the write. As with bit addressable inputs, the complementary bit addresses can be given software names like VALVE/ON, VALVE/OFF, BELL/ON, etc. Nothing, software-wise, could be simpler or faster.

Finally, some output functions have the form of one-bit pulses or triggers. These might be external clocks, resets, etc. To achieve a pulse output with a byte-style port requires loading output status, ANDing the selected bit off, writing out the new status, ORing the bit back on, and writing out the new status. This takes a minimum of five instructions and thirteen bytes. A pulsed output can be obtained directly from an unused individual write strobe as shown in Figure 4. If many pulse-type outputs are required, a single write strobe can be further decoded into eight (or more) strobes. The software now reduces to STA PULSE, STA CLEAR, STA COUNTUP, etc. and, again, the accumulator does not have to be changed since it provides no data.

It should be clear now that controller I/O need not be limited to the expensive, slow, fragile, power-hungry I/O provided by family port chips. To be sure, there are applications for which these chips are the best choices, but perhaps there are many more applications where a little creative design will produce a better (and cheaper) solution. ©

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VIC's Perpetual Calendar

Robert Lewis
Decatur, IL

Have you ever wanted to see a calendar for next year? Last year? Or the year you were born? This program is able to produce a *correct* calendar for any year after 1900. There are other starting years in program lines 10-60. These years are 1950, 1800, and 1582; the year today's calendar was started.

To change the starting year, delete the REM statement from the year wanted *and* the next following line. Be sure to add REM statements to the old lines or you may get an error when the program is run.

To use the program simply INPUT the full year (example: 1982) when asked "YEAR WANTED?". After entering the date, the program uses a loop to find what day of the week January first falls on in that year. A large difference in the entered and starting years may cause a delay of several seconds.

When it leaves the loop, it checks if it is a leap year and adjusts the count. There are several checks for leap year by the formula: IF Y/4 = INT (Y/4)THEN...

The last half of the program is devoted to displaying each month on the screen. The VIC's 22 character screen is an asset! The display consists of (starting from the top) the year, the number of days passed and left, the month, the days of the week and, finally, the dates. February and the days left and passed are automatically compensated for in leap years. All calendars start with January and each preceding month is displayed by pressing any key but (F1). When (F1) is pressed, the program asks for another "YEAR WANTED?" with a statement about the starting year. This also occurs when you enter a date before the starting year. At December, when you press a key, the program goes to January of the next year.

```
10 REM REMOVE REMARK FROM YEAR DESIRED AND
     ADJACENT LINE
15 REM AND ADD TO THE OLD LINES
20 REMYY=1800
21 REMCC=2
30 YY=1900
31 CC=1
40 REMYY=1950
41 REMCC=0
50 REMYY=1582
60 REMCC=2
65 REM INSTRUCTIONS
70 POKE36879,8
80 B1$="  VIC'S      ":  B2$="  PERPETUAL ~
    ":  B3$="  CALENDAR   "
90 PRINT"{CLEAR}":PRINT:PRINT"{REV}{GRN}  ~
      "
100 PRINT"{REV}        _"
110 PRINT"{REV}         _"
120 FORI=1TO13:PRINTTAB(I-1)"_{REV} "MID$(B
    3$,I,1);" ";MID$(B2$,I,1);" ";MID$
    (B1$,I,1);" _{OFF}
125 NEXTI
130 PRINT"{WHT}BY:{GRN}";SPC(I-4);"_{REV}  ~
        {OFF}"
140 PRINTSPC(I);"_{REV}       {OFF}"
150 PRINT"{WHT}ROBERT LEWIS{GRN}";SPC(I-11)
    ;"_{REV}     "
160 PRINT"{HOME}":PRINT:PRINT:PRINT"{REV}{Y
    YEL}"SPC(15);YY;"{LEFT} {OFF}":PRI
    NTSPC(17)"'%"
165 PRINTTAB(15);"{REV} ???? {OFF}"
170 PRINT:PRINTTAB(15)"{CYN}INST?"
180 GETA$:IFA$=""THEN180
190 IFA$="N"THEN330
200 PRINT"{GRN}{CLEAR} THIS PROGRAM MAKES  ~
     UP A CALENDAR FOR ANY"
210 PRINT"YEAR {RED}{REV}AFTER";YY;"{OFF}."

220 PRINT:PRINT"{CYN} OTHER STARTING YEARS ~
    ARE IN LINES 10-60."
230 PRINT:PRINT"{BLU} TO ENTER ANOTHER CAL-
    ENDAR YEAR PRESS {REV}F1{OFF}."
240 PRINT:PRINT"{YEL} THE YEAR ALWAYS BE-  ~
    GINS IN JANUARY.  TO "
250 PRINT"SEE THE FOLLOWING     MONTHS PRES
    S ANY OTHER KEY.";
260 PRINT" {PUR}(IN DECEMBER THE CALENDAR G
    OES TO THE NEXT YEAR)":PRINT
270 INPUT"{WHT}YEAR WANTED";Y
280 DA=365:IFY/4=INT(Y/4)THENDA=366
290 H=0:DB=DA
300 IFY>YYTHEN360
310 RESTORE
320 K=0
330 PRINT"{CLEAR}{WHT}I CAN'T START BEFORE ~
    ";YY
340 POKE36879,8
350 GOTO270
355 REM YEAR LOOP
360 Z=Y-YY:C=CC
370 FORI=1TOZ
380 C=C+1:YX=YY+I
390 IFYX/4=INT(YX/4)THENC=C+1
400 IFC>=7THENC=C-7
410 NEXTI
420 IFY/4=INT(Y/4)THENC=C-1:IFC<0THENC=7+C
```

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```
425 REM READS MONTH
430 READM$,M:S=LEN(M$)
435 REM ADJUST FOR LEAP YEAR
440 IFM=3AND(Y/4=INT(Y/4))THENM=2
450 IFC>7ORC=7THENC=C-7
460 B=C
490 REM PRINTS MONTH
500 PRINT"{BLK}":K=K+1:IFK=6THENK=0
510 POKE36879,40+(K*16)
520 PRINT"{CLEAR}":PRINT"{REV}"TAB(8);Y;"{L
    LEFT} {OFF}"
530 PRINTTAB(1);H;TAB(16);DB
540 PRINTTAB(10-(S/2))"0";:FORI=1TOS:PRINT"
    @";:NEXTI:PRINT"."
550 PRINTTAB(10-(S/2))"]{REV}";M$;"{OFF}]"
560 PRINTTAB(10-(S/2))"-";:FORI=1TOS:PRINT"
    @";:NEXTI:PRINT"="
570 PRINT:PRINT" S  M  T  W  T  F  S ":PRIN
    T
580 PRINTSPC(3*B);
590 FORI=1TO31-M
600 PRINTI;:IFI>9THENPRINT"{LEFT}";
610 IFPOS(0)>19THENPRINT:PRINT
620 NEXTI:PRINT
700 GETX$:IFX$=""THEN700
705 REM NEW DATE WANTED
710 IFX$="{F1}"THEN310
715 REM SETS UP NEXT
716 REM MONTH OR YEAR
720 C=B+3-M
730 IFM$<>"DECEMBER"THEN790
740 RESTORE
750 Y=Y+1
760 H=O:DB=365:IFY/4=INT(Y/4)THENDB=366
770 DA=DB
780 GOTO430
790 DB=DB-(31-M):H=DA-DB
800 GOTO430
810 END
1000 DATA JANUARY,0,FEBRUARY,3,MARCH,0,APRIL
    ,1,MAY,0,JUNE,1,JULY,0
1010 DATA AUGUST,0,SEPTEMBER,1,OCTOBER,0,NOV
    EMBER,1,DECEMBER,0
```

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A Subroutine Aid To Debugging Atari BASIC

Mark Thomas Greene, Ph.D.
Columbus, OH

Tired of searching through your BASIC manual, 850 manual, and DOS manual to find out what ERROR 175 means? This program should end that frustration once and for all.

The subroutine acts as a BASIC diagnostic that: a. describes in some detail what went wrong, b. indicates the line at which the error occurred, and c. lists the immediate environment of the problem line.

Here's how it works:

Line: 0 TRAP 30000

This causes the system to run the debugging routine whenever an error occurs. The subroutine should be stored on disk via a LIST command (e.g. L. "D:ERRORS.LST") so that it may be merged with any program by means of an ENTER command (e.g. E."D:ERRORS. LST"). Use of line 0 and lines 30000 through 31173 makes it easy to avoid overwriting an existing program with "ERRORS" and vice-versa.

Any time a different TRAP is needed, TRAP 30000 should be reset as soon as possible.

Line: 30010 ? " [ESC] [CNTL CLR]"

This statement clears the screen.

Line: 30020 STPLN1 = PEEK(187): STPLN2 = PEEK(186)

This statement retrieves the two byte representation of the line number at which the error occurred.

Line: 30030 ERR$ = "31"

We're going to build a line number beginning with thirty-one thousand and ending with the error number.

Line: 30040 IF PEEK(195) < 100 THEN ERR1$ = '0'

Line: 30050 IF PEEK(195) < 10 THEN ERR1$ = '00'

These lines create place holders in front of the error number if the error number is less than three digits long. Line 30050 overrides 30040 if the error number [PEEK(195)] is a single digit.

Line: 30060 ERR$(LEN(ERR$) + 1) = ERR1$

This line adds the appropriate number of zeros to ERR$ ('31'). If the error number is three digits long it will have no effect.

Line: 30070 ERR$(LEN(ERR$) + 1) = STR$ (PEEK(195)

This line adds the error number to our string so that we have a five digit string beginning with '31' and ending with the error number.

Line: 30080 GOSUB VAL(ERR$)

This statement converts our string to a five digit number. GOSUB then executes the sub-

Program 1.

DIM Error: Attempt to reDIM or, DIM > 32767 or, reference out of DIMed size or not DIMed.

The error occurred at line 3345.

```
3330 DB$(LEN(DB$)+1)=CHR$(155)
3340 DB$(LEN(DB$)+1)=STR$(LVL)
3345 DB$(LEN(DB$)+1)=ANS$
3350 DB$(LEN(DB$)+1)=CHR$(155)
3360 DB$(LEN(DB$)+1)=BONUS$
```

Program 2.

```
Readers with cassette systems can
use this program by inserting a
blank tape in the 410 recorder,
and rewinding to start.  Press PLAY
and RECORD, then enter:
     LIST "C:"
and then press <RETURN> twice.  To
add this program to a program you
already have in memory, insert your
```

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"Errors" tape, rewind, press PLAY, and enter:

ENTER "C:"

and press <RETURN> twice. The program will be merged with yours. Remember that the routine uses line zero, so if you have a line zero in your program, it will be replaced. Also, you may have to change any TRAP 40000 or TRAP 32768 statements to TRAP 30000.

```
0 TRAP 30000
30000 REM *******ERROR TRAP*********
30005 DIM ERR$(10),ERR1$(10)
30010 ? "{CLEAR}"
30020 STPLN1=PEEK(187):STPLN2=PEEK(186)
30030 ERR$="31"
30040 IF PEEK(195)<100 THEN ERR1$="0"
30050 IF PEEK(195)<10 THEN ERR1$="00"
30060 ERR$(LEN(ERR$)+1)=ERR1$
30070 ERR$(LEN(ERR$)+1)=STR$(PEEK(195))
30080 GOSUB VAL(ERR$)
30090 POKE 195,0
30095 STPLN=256*STPLN1+STPLN2
30100 ? "The error occurred at line ";ST
PLN;"."
30110 LIST STPLN-20,STPLN+20
30120 END
31002 ? "Not enough memory to store stat
ement  or the new variable name or to DI
M a  new string variable.":RETURN
31003 ? "A value expected to be a + inte
ger    isn't: a value expected to be in
a   specific range isn't.":RETURN
31004 ? "Too Many Variables: A maximum o
f 128  variable names is allowed.":RETUR
N
31005 ? "String Length Error: Attempted
to     store beyond the DIMensioned stri
ng   length.":RETURN
31006 ? "Out of Data Error:READ statemen
t      requires more data than supplied
by   data statement(s).":RETURN
31007 ? "Number Greater than 32767:Value
 is nota positive integer or is greater
than 32767.":RETURN
31008 ? "Input Statement Error: Attempte
d to   input a non-numeric value into a
     numeric variable.":RETURN
31009 ? "DIM Error: Attempt to reDIM or,
DIM >  32767 or, reference out of DIMed
size or not DIMed.":RETURN
31010 ? "Argument Stack Overflow: There
are toomany GOSUBs or too big an express
ion.":RETURN
31011 ? "Attempt to divide by zero or re
fer to a number >10E98 or <10E-99.":RETU
RN
31012 ? "Line Not Found: A GOSUB, GOTO o
r THEN referenced a non-existant line nu
mber.":RETURN
31013 ? "No Matching FOR Statement: Nest
ed     FOR/NEXT statements do not match
or noFOR statement.":RETURN
31014 ? "Line too long: The Statement is
 too   long or complex for basic to hand
le.":RETURN
31015 ? "A NEXT or RETURN was encountere
d and  the GOSUB or FOR has been deleted
     since the last RUN.":RETURN
31016 ? "RETURN Error: A RETURN was enco
unteredwithout a matching GOSUB.":RETURN

31017 ? "Garbage Error: Execution of bad
 RAM   bits was attempted. Usually a har
dwareor POKE problem.":RETURN
31018 ? "String does not start with a va
lid    character, or string in VAL state
ment is not a numeric.":RETURN
31019 ? "LOAD Program too Long: Insuffic
ient   RAM to complete load.":RETURN
31020 ? "Device number larger than 7 or
equal  to 0.":RETURN
31021 ? "LOAD File Error: Attempt to LOA
D a    non-LOAD file.":RETURN
31128 ? "BREAK Abort: User hit |BREAK| k
ey duringI/O operation.":RETURN
31129 ? "IOCB already open.":RETURN
31130 ? "Nonexistent device specified.":
RETURN
31131 ? "IOCB Write Only: READ command t
o a    write only device.":RETURN
31132 ? "Invalid Command: The command is
        invalid for this device.":RETURN

31133 ? "Device or File not Open: No OPE
N      specified for this device.":RETUR
N
31134 ? "Bad IOCB Number:Illegal device
number.":RETURN
31135 ? "IOCB Read Only Error: WRITE com
mand toa read-only device.":RETURN
31136 ? "EOF: End of File has been reach
ed.":RETURN
31137 ? "Truncated Record: Attempt to re
ad a   record longer than 256 characters
.":RETURN
31138 ? "Device Timeout: Device doesn't
        respond.":RETURN
31139 ? "Device NAK: Garbage at serial p
ort or bad disk drive.":RETURN
```

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```
31140 ? "Serial bus input framing error.
":RETURN
31141 ? "Cursor out of range.":RETURN
31142 ? "Serial bus data frame overrun."
:RETURN
31143 ? "Serial bus data frame checksum
error.":RETURN
31144 ? "Device Done Error: (invalid 'do
ne'    byte): Attempt to write on a writ
e-   protected diskette.":RETURN
31145 ? "Read after write compare error
(disk  handler) or bad screen mode handl
er.":RETURN
31146 ? "Function not implemented in han
dler.":RETURN
31147 ? "Insufficient RAM for operating
in      selected graphics mode.":RETURN
31150 ? "Port Already Open: Attempt to O
PEN an RS-232 port already open through
      another IOCB.":RETURN
31151 ? "Concurrent I/O mode not enabled
: Aux1 bit 0 not set for XIO 40.":RETURN

31152 ? "Illegal User Supplied Buffer: B
uffer  length and/or address inconsisten
t in concurrent I/O mode.":RETURN
31153 ? "Active Concurrent I/O Error: At
tempt  to perform RS-232 I/O while concu
rrentmode I/O active.":RETURN
31154 ? "Concurrent Mode not Active: Con

currentI/O mode must be activated in ord
er toperform INPUT or GET.":RETURN
31160 ? "Drive number error."
31161 ? "Too many OPEN files (no sector
buffer available)]":RETURN
31162 ? "Disk full (no free sectors)]":R
ETURN
31163 ? "Unrecoverable system data I/O e
rror.":RETURN
31164 ? "File Number Mismatch: Links on
disk   are messed up.":RETURN
31165 ? "File Name Error.":RETURN
31166 ? "POINT data length error.":RETUR
N
31167 ? "File locked.":RETURN
31168 ? "Command invalid (special operat
ion    code).":RETURN
31169 ? "Directory full (64 files).":RET
URN
31170 ? "File not found.":RETURN
31171 ? "POINT invalid.":RETURN
31172 ? "Illegal Append: DOS 1 cannot ap
pend toa DOS 2 file.":RETURN
31173 ? "Bad Sectors at Format Time:Disk
 drive found bad sectors while formattin
g a   diskette.":RETURN
```


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routine of that number. Each subroutine is contained entirely by that line. The subroutine prints the description unique to that error and then RETURNS to line 30080.

Line: 30090 POKE 195,0
This statement resets the error number to zero.

Line: 30095 STPLN=256*
STPLN1+STPLN2
Line 30095 converts the two byte "binary" line number to its decimal equivalent. (See Line 30020.)

Line: 30100 ? "The error occurred at line ";STPLN;"."
This line prints the decimal value of the error line.

Line: 30110 LIST STPLN-20, STPLN+20
This statement prints the statements immediately before, after and including the error.

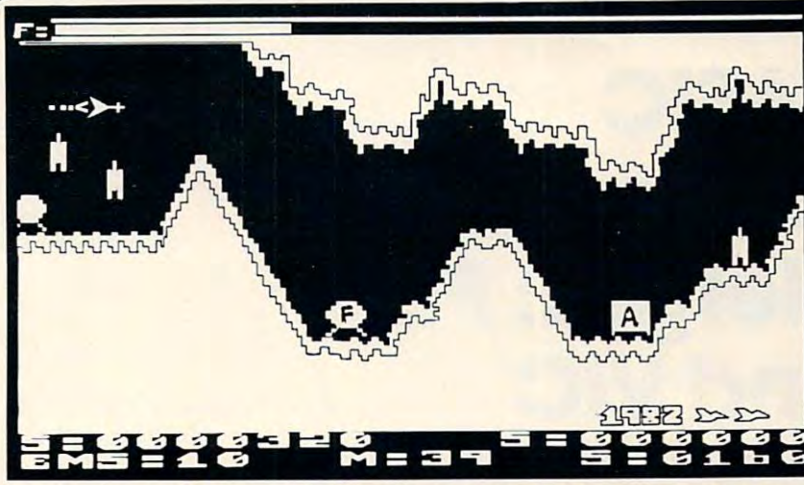
The result of such an error is presented in Program 1.

Now you say, "This system will work for errors encountered during program execution but what about errors in direct mode?" Aha! It can still save trips to the manuals. As long as 'ERRORS' is loaded in RAM, just type GOSUB 31xyz where xyz is your error number, and a description of your latest error will appear. Disregard the information about line numbers.

I have loaded "ERRORS" on to my master diskette so that it is automatically transferred to each disk along with the DOS programs whenever I create a new workdisk by duplicating the master.

The errors listed here may be changed or expanded to adapt to your hardware and software (e.g., the line printer and word processor software). A similar method may be used to trap the ASSEMBLER errors replacing BASIC errors one through nineteen.

Program 2 is the complete program. ©



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BASIC Program Merges: PET And VIC

Jim Butterfield
Toronto

If you have two BASIC Programs, it's hard to consolidate them together without getting typer's cramp. The command LOAD wipes the old program as it loads in the new one. This is a disappointment. There are times when you have a group of DATA statements in a program and would like to bring them into another program which will use them for a new set of computations. The same thing is true of your favorite subroutines: it's annoying to have to type them in all over again.

Merging – true merging, that is – solves this for you. You can arrange to slip extra lines into your program as if you had typed them in at the keyboard.

VIC To PET Transfers

Merging can be used to transfer BASIC programs from VIC to PET. A merged program will occupy the proper memory addresses as it arrives into the PET. LOADing a VIC program into the PET often doesn't work.

There are potential problems in moving a program between VIC and PET. For one thing, VIC color won't show on a CBM/PET.

If the program has PEEKs and POKEs, chances are it will take quite a bit of work to fit it into the other machine. If you're lucky, they can be changed to PEEK or POKE a new set of addresses; but it's not always possible to find a one-to-one translation between VIC and PET.

If the program contains machine language – look for a SYS command or USR function – you'll probably have problems cutting it over to the new machine. Some machine language programs won't even work on all models of PET – so a move to or from VIC would be much too big a shock. And the method that I will outline below won't work on machine language programs, anyway; just pure BASIC.

Writing Out The Program

To transfer a BASIC program, we're going to write cassette tape in an unusual way. It won't be a normal program tape: instead, it will be something called an ASCII listing tape. It will take about twice as long to write, and occupy about twice as much tape ... but it will be compatible.

Here's how to write this type of tape. Type:

```
OPEN 1,1,1,"PROGNAME" : CMD 1 : LIST
```

... and as soon as you press the RETURN key, you'll be requested to PRESS PLAY AND RECORD ... Do it, and the tape will start. If you watch carefully, you may see the tape hesitating every few seconds or so. Eventually the tape will stop. When it does, type:

```
PRINT #1 : CLOSE 1
```

... and tape will move one last time. When it stops, the computer will say READY and you may rewind the tape and take it out of the drive.

You have some options on the above procedure. You may call the ASCII listing anything you like: instead of PROGNAME you can call it WHISKERS or CLOUD 9. It's a good idea to give a meaningful name to tape files; when you have fifty or more tapes sitting around you'll be very happy to get a hint as to what's on a given tape. You could (if you wished) write part of a program to tape instead of the whole thing: for example, you might type LIST 300-400 instead of just LIST in the first line.

You have quite a miraculous thing on the cassette tape. It's a program, but it's written as a data file. We could read the program as if it were data, analyze it, and do any kind of computing on it we wanted to. That's unusual: programs are programs and data are data ... they seldom mix.

Getting Ready To Bring It Back

When we recall the program from this oddly formatted tape, we will bring in the lines, one at a time, and merge them with any program already in place in the computer. It will work just as if we typed the lines: new lines will fit into the program in the correct line number sequence; and if a new line number matches an old one, the new line will replace the old one.

If we are just transporting a program from VIC to PET, we must say NEW. This means that we are merging the program with nothing. The result will be the program by itself – but properly placed in the PET.

If we want to merge the program we have saved with another program, now's the time to bring that other program into your computer. The lines from tape will mix in.

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The Magic Merge

Don't try to understand it. Just do it carefully. In the following, PET4 is for 4.0 Machines, PETU is for PET Upgrade Machines (they power up with ### Commodore Basic ###) and PET1 is for the Original ROM machines.

Put your "merge tape" – the one we just wrote – into the cassette drive of the computer. Now type:

```
  VIC:  POKE 19,1 : OPEN 1
 PET4:  POKE 16,1 : OPEN 1
 PETU:  POKE 13,1 : OPEN 1
 PET1:  POKE  3,1 : OPEN 1
```

... and when you press RETURN, you'll be asked to PRESS PLAY... Do it, and the tape will move briefly and the computer will report FOUND PROGNAME.

We're almost there, but you must follow the next instructions very, very carefully. Clear the screen, and type exactly three cursor down characters. Watch it! The cursor-down key may repeat if you hold it too long. Type the following starting on line 4 (if you've followed instructions, you must be on line 4, right?):

```
  VIC: PRINT"[home]":POKE 198,1:POKE 631,13:
       POKE 153,1
 PET4: PRINT"[home]":POKE 158,1:POKE 623,13:
       POKE 175,1
 PETU: PRINT"[home]":POKE 158,1:POKE 623,13:
       POKE 175,1
 PET1: PRINT"[home]":POKE 525,1:POKE 527,13:
       POKE 611,1
```

The designation [home] above means: press the home key; the computer will print a reverse-S character. Don't type the letters H-O-M-E; that won't get you anywhere. After you've input the above line, press RETURN and things will suddenly get very busy. The cassette tape will start to move, and it will keep moving with brief stops for some time. There will be no sign of activity on the screen, except that the word READY may mysteriously appear above the line you typed.

Eventually the tape will stop moving and an error notice will print. It might be ?OUT OF DATA and it might be ?SYNTAX ERROR – but, in either case, ignore it: it's not a real error. To be neat, you should now type CLOSE 1.

Your program is now in the machine. You may go ahead and use it, or SAVE it in the more conventional way for future use.

How It Works

It's magic.

The basic procedure was evolved by Brad Templeton. If you want more details and happen to run across Brad, ask him. But you'd better have a week to spare.

You can merge programs together. You can transfer programs from VIC to PET (or vice versa, for that matter). But we've only just begin to tap the treasures of the Merge sequence.

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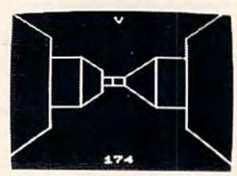

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Insight: Atari

Bill Wilkinson
Optimized Systems Software
Cupertino, CA

This month has been a most hectic one. We just finished exhibiting both our new and old products at the seventh West Coast Computer Faire. (The seventh? Is that possible? I remember attending the first!) And, of course, we saw many, many, many new products for Atari Computers there. (Oh, all right, there were some for those other brands, also.) As I have said before, I won't review other companies' software products in this column, but I hope my dear editor won't object if I mention some of the more prominent new hardware products. Presumably, we will be seeing full blown reviews of these products in these pages in the future. And, since **COMPUTE!** was also there, I won't do more than just the mentions.

New Atari Peripherals

There were two companies there with add-on disk drives for the Atari: Percom Data Corporation and MPC Peripherals. It is hoped that both will be delivering double density drives by the time you read this, and the word is that we can expect double-sided, double-density very soon.

32K Byte memory cards were in abundance. And, of course, there was already Axlon's RAM-DISK. And how about a 64K card for the Atari 400? It's availble now in Germany. I'm not sure when and/or how it will appear here.

The long-awaited 24-by-80 display (24 lines of 80 characters, instead of Atari's 40 characters) was shown by BIT3 Corporation (who make a similar board for the Apple II).

And Stargate Enterprises (an Atari dealer near Pittsburgh, PA) brought and demonstrated the most innovative prototype: a small, radio-controlled robot. This might not sound exciting until you realize that the controlling end of the radio link was being driven by an Atari.

And wouldst that I could go into the software. Some of the latest arcade games have been, or are being, converted to Atari. And many of the best Apple II games will shortly appear for us, also. The best is yet to come, I believe. My aching pocketbook.

Anyway... as a consequence of all this, I simply didn't have time this month to do a fancy, full-blown program like last month's. Instead, I will just note a couple of the things I've been carrying around on spare scraps of paper before they get lost. But this won't be a short column; part five of my series on the internals of Atari BASIC is a fairly long and complex article on how variables are used and accessed and more. But first, the tidbits.

Control One Atari Screen

I am constantly amazed at the number of Atari owners (and not necessarily new owners) who are not aware that you can temporarily halt text screen output. They are forever typing LIST (for example) and then trying to hit the BREAK key at exactly the right time. For shame! You didn't read your manuals.

To temporarily pause, simply hit CONTROL-1 (hold down the CTRL key and hit the numeral 1 key). To continue, hit CONTROL-1 again. That's all there is to it.

Now, don't you feel silly? Would it help if I told you that somebody had to tell me, too?

Y Not Do It Later?

There is a minor, but terribly frustrating, bug in the Atari Assembler/Editor cartridge. There is no fix, but it is relatively easy to avoid if one is aware of it. So, if you haven't already been bitten, here is some bug repellant.

The problem has to do with using the ComPare-Y immediate instruction (CPY #xxx) when using the cartridge's debugger. One cannot always Step or Trace through such an instruction. Usually, an attempt to do so will cause the instruction to be treated as a BReaK (though I have heard tales of systems crashing).

The sort-of-a-solution is simply to avoid the instruction altogether. If possible, use CPX instead. Or try the following:

```
WAS:       NOW:
CPY #7     CPY VALUE7
           ...
           VALUE7 .BYTE 7
```

This new method eats up two more bytes of memory, but the CPY# should be a fairly rare instruction so this technique won't make a lot of difference.

Using Print Without Using

Every now and then, I see a routine listed and/or used that is supposed to simulate PRINT USING on a BASIC that doesn't have such a capability. (For those of you who don't know what PRINT USING is, suffice to say that it is a very nice tool which allows beautifully formatted numeric output.) Well, I couldn't let these routines go unchallenged, since I had also designed such a routine many years ago. So here is that routine spruced up for Atari BASIC:

```
32000 REM formatted money
32010 TRAP 32020 : DIM QNUM$(15) : TRAP 40000
```

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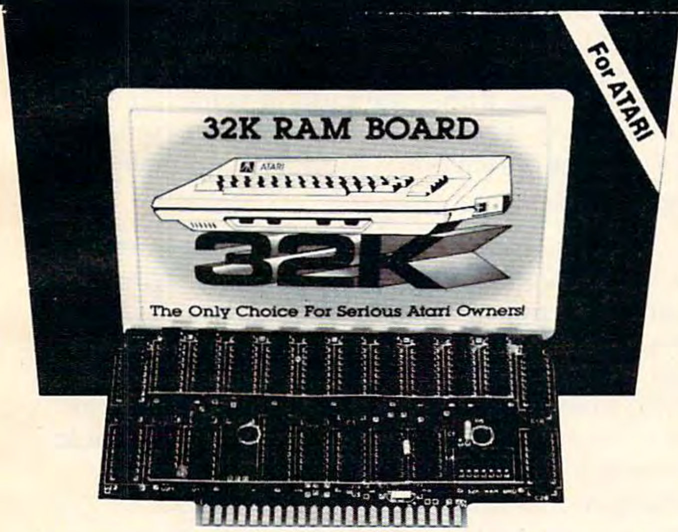

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```
32020 IF ABS(QNUM) >= 1E8 THEN QNUM$=
      STR$(QNUM) : RETURN
32030 QNUM$="^$^^^^^^^^.^^^^": IF QNUM<0 THEN
      QNUM= -QNUM : QNUM$="($^^^^^^^^.^^)^"
32040 QNUM$(11-LEN(STR$(INT(QNUM))),10)=
      STR$(INT(QNUM))
32050 QNUM$(11,13)=STR$(100+INT((QNUM-INT
      (QNUM))*100+0.5)): QNUM$(11,11)=".":
      RETURN
```

Alternatively, you might replace the last statement of line 32030 with

```
QNUM$(14,15)="CR"
```

NOTE: to facilitate your counting, I have used an up arrow ("^") where you should type a space.

To use the routine, simply place the number you want formatted into QNUM and GOSUB 32000. The routine returns with the formatted string in QNUM$. Some things to observe about the routine: it uses no temporary variables, it dimensions its own string (but only once; notice the TRAP), it could be easily translated to any Microsoft BASIC that allowed MID$ on the left side of the equal sign.

Inside Atari BASIC: Part V

Last month we discussed the seven main memory pointers used by Atari BASIC and BASIC A+, and I promised to make the variable table the main topic for this month. In addition, I said that we would learn how to fool BASIC in useful ways. Many of the techniques I will present this month are *not* my original ideas: I must credit many sources, including *De Re Atari* and *COMPUTE!'s First Book of Atari*. However, the material bears repeating; and perhaps I can give some deeper insight into why and how some of the tricks work.

The Structure Of The Variable Value Table

Please recall from previous articles that the variable value table (VVT) of Atari BASIC is kept distinct from the variable name table. The reason for this is to speed run-time execution. Recall that the tokenized version of a variable is simply the variable's number plus 128 (80 hex), resulting in variable tokens with values from 128 to 255 ($80 to $FF). Since each entry in the VVT is eight bytes long, the conversion from token to address within VVT is fairly simple. For those of you who are interested, the following code segment is a simplified version of the actual code as it appears in BASIC:

```
; we enter with the token value
; ($80 through $FF) in A register
;
      LDY  #0
      STY  ZTEMP+1     ;a zero page temporary
      ASL  A           ;token value * 2
                       ; but ignore the high bit
      ASL  A           ; token value * 4
      ROL  ZTEMP+1     ; carried into MSB also
      ASL  A           ; token value * 8
      ROL  ZTEMP+1     ; again, into MSByte
      CLC  ; (not needed ... included for clarity)
      ADC  VVTP        ; add in LSB of VVT Pointer
      STA  ZTEMP       ; gets LSB of pointer to var
      LDA  ZTEMP+1
      ADC  VVTP+1      ; add the two MSBs
      STA  ZTEMP+1     ; to obtain complete pointer
      LDA  (ZTEMP),Y   ; see text
```

When we exit this routine, ZTEMP has become a zero-page pointer that points to the appropriate eight-byte entry within the variable value table. But just what does it point to? The A-register contains the first byte of that entry. What is that first byte? Read on...

Since each entry in the VVT is eight bytes long (yet may be a simple numeric variable, a string, or an array) obviously the entries must vary in contents. However, the first two bytes always have the same meanings. In particular, the first byte is the "flags" byte, and the second byte is a repeat of the variable number (without the MSBit on). We could probably have dispensed with the repeat of the variable number; but including that byte made the entry size come out to eight bytes (more convenient), and we found several uses for it in the actual implementation.

The "flags" byte is the heart of the whole VVT scheme: until BASIC examines a variable's flag byte, it doesn't even know whether it is working with a string, array, or scalar. But note how neatly we managed to arrive at the end of the routine above with the appropriate flag byte safely in the A-register, where it can easily be checked, compared, or whatever. This, then, is the meaning of the individual bits within the flags byte:

Bit Number	Hex Value	Meaning (if bit is on)
0	$01	Array or String is DIMensioned
6	$40	this is an Array
7	$80	this is a String

Note that there is no special flag that says "this variable is a simple scalar numeric." Instead, the absence of all flags (i.e., a $00 byte) is used to indicate such variables. Since we have now used the first two bytes of each VVT entry, we now have to figure out what to do with the remaining six bytes. It is no coincidence that Atari floating point numbers consist of six bytes (a one byte exponent and a five byte mantissa): that numeric size was purposely chosen as one that gave a reasonable degree of accuracy as well as reasonable efficiency on the VVT layout. (Yes, I know, seven bytes would have worked well also, especially if we hadn't used the

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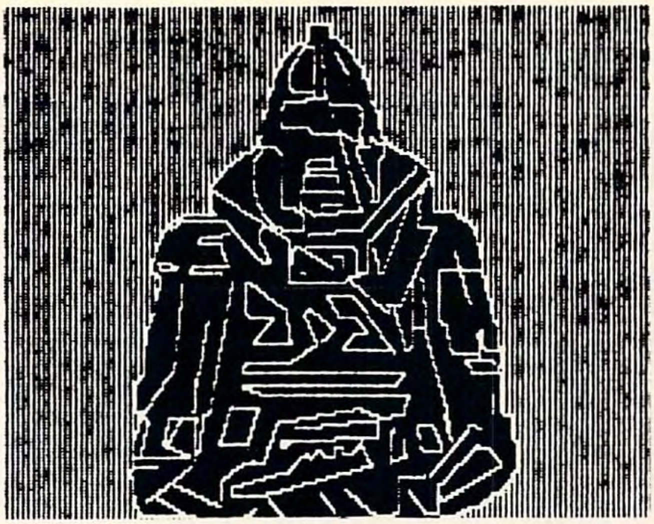

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redundant variable number. Oh well.)

So scalar numeric variables obviously have their value contained directly in the VVT (hence the name, variable *value* table). But what about strings and arrays, which might be any size? The answer is yet another set of pointers, etc. Before proceeding, let us examine the layout of the three kinds of VVT entries, including the already-discussed scalar type:

BYTE NUMBER	0	1	2 3	4 5	6 7
SCALARS	00	vnum	(floating point #, 6 bytes)		
STRINGS	80/81	vnum	address	LENgth	DIM
ARRAYS	40/41	vnum	address	DIM1+1	DIM2+1

For strings and arrays, byte zero (the flag byte), varies depending upon whether or not the variable has yet been DIMensioned. (Incidentally, BASIC always resets bit zero of the flag byte and zeros bytes two through seven for all variables whenever you tell it to RUN a program.)

The "address" in bytes two and three of string and array variables is *not* the actual address where the string or array is located. Instead, it is actually an offset (or, if you prefer, relative address) within the string/array space allocated to the program. Recall from last month that location $8C (140 decimal), names STARP (STring and ARray Pointer), points to the base location of such allocated space. Thus, for example, when BASIC receives a request for "ADR(XX$)", it simply uses the variable number (for XX$, which was generated when the program was typed in) to index into VVT (as above), and then retrieves the "address" from the VVT entry and adds it to the current contents of STARP.

For strings, the length and dimension values seem obvious: the DIM value is what you specify with the BASIC DIM statement, and the length is the same as that returned by the LEN function.

For arrays, we need note that DIM1 and DIM2 are as specified by the programmer in the DIM statement [e.g., DIM ARRAY(3,4)]. The reasons they are incremented by one in VVT are twofold: a zero value is used to indicate "dimension not in use" (obviously only effective for DIM2, since flag bit 0 will not be set if neither is in use) also, since the zeroeth element of an array is accessible (whereas the zeroeth character of a string is not), using DIM+1 makes out-of-range comparisons easier.

And that's it. There really are no other magic tricks or secrets. Once DIMensioned, strings and arrays don't change their offsets (relative addresses) or dimensions. There are no secret flag bits that mean funny things. Turning on the MSBit of the variable number only spells disaster. I really have told all.

Making Use Of What We Know

BASIC is not smart enough to check entries in these tables for validity. It assumes that once you have declared and/or DIMensioned a variable the VVT entry is correct (it must be...BASIC made it so). Thus the implication is that one can go change various values in VVT and BASIC will believe the changes. So let's examine what we can change and what effects (good and bad) such changes will have.

First, as usual, some cautions: BASIC DIMensions variables in the order the programmer specifies. Thus "DIM A$(100),B(10)" will ensure that the address of array B will be 100 higher than that of string A$. Neat, sweet, petite. *However*, the order in which variables appear in the VVT (and Variable Name Table) depends entirely upon the order in which the user ENTERED his program. An example:

```
NEW
20 A=0
40 DIM B$(10)
10 DIM C$(10)
30 DIM D(10
LIST
[and BASIC responds with:
  10 DIM C$(10)
  20 A=0
  30 DIM D(10)
  40 DIM B$(10)
```

Assuming that you typed in the lines above in the order indicated, the variables shown would appear in VVT in alphabetical order (A,B$,C$,D). But, if you RUN the program, the DIMensioned variables would use string/array space as follows:

```
C$,  10 bytes, offset  0 from STARP
D(), 66 bytes, offset 10 from STARP
B$,  10 bytes, offset 76 from STARP
```

Though you can figure out this correspondence (especially if you list the variable name table, with a short program in Atari BASIC or with LVAR in BASIC A+), it is probably not what you would most desire. It would be handy if the VVT order and the string/array space order were the same. Solution: (1) Place all your DIMensions first in the program, ahead of all scalar assignments. (2) LIST your program to disk or cassette, NEW, and reENTER – thus insuring that the order you see the variables in your program listing is the same order that they appear in the VVT. From here on in this article I will assume that you have taken these measures, so that variable number zero is also the first variable DIMensioned, etc.

So let's try making our first change. The simplest thing to change is STARP, the master STring/ARray Pointer. A simple program is prob-

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ably the easiest way to demonstrate what we can do:

```
100 DIM A$(24*40) : A$(24*40)=CHR$(0)
110 WAIT = 900
120 A$(1,24)="THIS IS ORIGINAL A$ !!! "
130 A$(25)=A$
140 PRINT A$ : GOSUB WAIT
150 SAV140=PEEK(140) : SAV141=PEEK(141)
160 TEMP = PEEK(560)+256*PEEK(561) + 4
170 POKE 140,PEEK(TEMP) : POKE 141,PEEK
    (TEMP+1)
180 PRINT CHR$(125);
190 A$(1,11)="HI there..." : GOSUB WAIT
200 A$(12)=A$ : GOSUB WAIT
210 POKE 140,SAV140 : POKE 141,SAV141
220 PRINT A$
230 END
900 REM WAIT SUBROUTINE
910 POKE 20,0 : POKE 19,0
920 IF NOT PEEK(19) THEN 920
930 RETURN
```

BASIC A+ users might prefer to delete line 160 and change the following lines:

```
150 sav140 = dpeek(140)
170 dpoke 140,dpeek(dpeek(560)+4)
210 dpoke 140,sav140
910 dpoke 19,0
```

" 'Simple', he said. Who's he kidding!" Honest, it's simpler than it looks. Lines 100 through 140 simply initialize A$ to an identifiable, printable string and print it. The WAIT routine is simply to give you time to see what's happening. Note that A$ is DIMensioned to exactly the same size (in bytes) as screen memory. We then save BASIC's STARP value and replace it with the address of the screen (lines 150 through 170). Since A$ is the first item in string/array space, its offset is zero. Thus pointing STARP to the screen points A$ to the screen.

We then clear the screen and initialize A$ again – to a short string. Notice the effect on the screen: capital letters and symbols are jumbled because of the translation done on characters to be displayed. (Recall that Atari has three different internal codes: keyboard code, ATASCII code, and screen code. Normally we are only aware of ATASCII, since the OS ROMs do all the conversions for us.)

At line 200, we proliferate our short string throughout all of A$ – look at the effect on the screen. Finally, lines 210 through 230, we restore STARP to its original value and print what BASIC believes to be the value of A$. Surprised?

As interesting as all the above is, it is of at best limited use: moving all of string/array space at once is dangerous. In our example above, if there had been a second string DIMensioned, it would have been reaching above screen memory, into never-never land. Let me know if you can find a real use for the technique.

A better technique would be one which would allow us to adjust the addresses of individual strings (or arrays). While a little more complex, the task is certainly doable. Our first task is to find a variable's location in the VVT. If the variable number is "n", then its VVT address is [VVTP]+8*n (where "[...]" means "the contents of ...").

In BASIC:

```
PEEK(134)+256*PEEK(135)+8*n
```

or BASIC A+:

```
dpeek(134)+8*n
```

We can then add on the byte offset to the particular element we want and play our fun and games. Again, a sample program might be the best place to start:

```
100 DIM A$(1025),B$(1025) : A$(1025)=CHR$(0) :
    B$=A$
110 STARP=PEEK(140)+256*PEEK(141)
120 VVTP=PEEK(134)+256*PEEK(135)
130 CHARSET=14*4096 : REM HEX E000
140 VNUM=1 : REM the variable number of B$
150 LET NEWOFFSETB=CHARSET - STARP
160 TEMP1=INT(NEWOFFSETB/256)
170 TEMP2=NEWOFFSETB - 256*TEMP1
180 POKE VVTP+VNUM*8+2,TEMP2 : POKE
    VVTP+VNUM*8+3,TEMP1
190 A$=B$
200 PRINT ADR(B$),CHARSET
```

optionally, in BASIC A+:

```
100 dim a$(1024),b$(1024) : a$(1024)=chr$(0) : b$=a$
110 starp=dpeek(140)
120 vvtp=dpeek(134)
130 charset=14*4096
140 vnum=1
180 dpoke vvtp+vnum*8+2,charset-starp
190 a$=b$
200 print adr(b$),charset
```

equivalently:

```
100 DIM A$(1024)
110 CHARSET=14*4096
120 FOR I=1 TO 1024
130 A$(I)=CHR$(PEEK(CHARSET+I-1))
140 NEXT I
```

or again, optionally, in BASIC A+:

```
100 dim a$(1024) : a$(1024)=chr$(0)
110 move 14*4096, adr(a$), 1024
```

The intent of all four of the above program fragments is the same: to move the Atari character set font from ROM (at $E000) into the string A$. The third method will probably be the most familiar to most of you. Unfortunately, it is also the slowest. The fourth method, admittedly is clearest in BASIC A+, though: its line 110 summarizes what we are trying to do in each of the other three.

The first method is of course the one which deserves our attention since it relates to this article.

Line 100 simply allocates and initializes our

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two strings. We must DIMension these strings one greater than we need because of the bug in Atari BASIC which moves too few bytes when string movements involve moving exact multiples of 256 bytes. Lines 110 and 120 simply get the current values of the two pointers that we need, VVTP and STARP.

Lines 130 and 140 actually simply set up some constants. The Atari character set is always located at $E000, of course. The VNUM is set to one, in accordance to what we noted above. *Be careful!* The VNUM will *not* necessarily be one if you did not type this program in the order shown! When all else fails, use LIST and reENTER.

We use line 150 to figure out how much B$ must move (and it will always move "up," since the ROM is always above the RAM) and then calculate its new "offset" within STARP. Of course, it is now actually outside of string/array space, but BASIC doesn't know that. Why should it care?

Unfortunately, lines 160 and 170 are needed in Atari BASIC (and most other BASICs) to manipulate 16-bit numbers into digestible, byte-sized pieces.

Finally, with line 180 we establish B$ as pointing to the character set memory. Line 190 moves the entire 1025 bytes, with one simple operation, from there to the waiting arms of A$, in RAM, where it can be manipulated.

With Atari BASIC (and, indeed, with most BASICs), the only other way to get the speed demonstrated here is to write an assembly language subroutine to do the move. Obviously, if you were simply moving the character set once, this is not the way to do it. But if you are interested in manipulating a lot of different memory areas with great speed (player missile graphics? multiple screens?), this works.

A couple of comments: We did not really need to DIMension

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and set up B$ in our example. After all, as long as we are faking the address, why not fake the DIMension, LENgth, and flags as well? We could accomplish all that this way:

POKE VVTP+8*VNUM, 65: REM say B$ is dimensioned ($41), see above)
POKE VVTP+8*VNUM+4,1: REM 1sb of 1025 ($0401), the length
POKE VVTP+8*VNUM+5,4: REM msb of ditto
POKE VVTP+8*VNUM+6,1: REM and the DIM is the same as the len
POKE VVTP+8*VNUM+7,4:REM msb of the DIMM

Now we have fooled BASIC into thinking B$ is set up properly but we haven't actually used any memory for it. P.S.: can you think of any reasons to have two variables pointing to the same memory space? A string and an array pointing the same space? We'll discuss all that next month. ©

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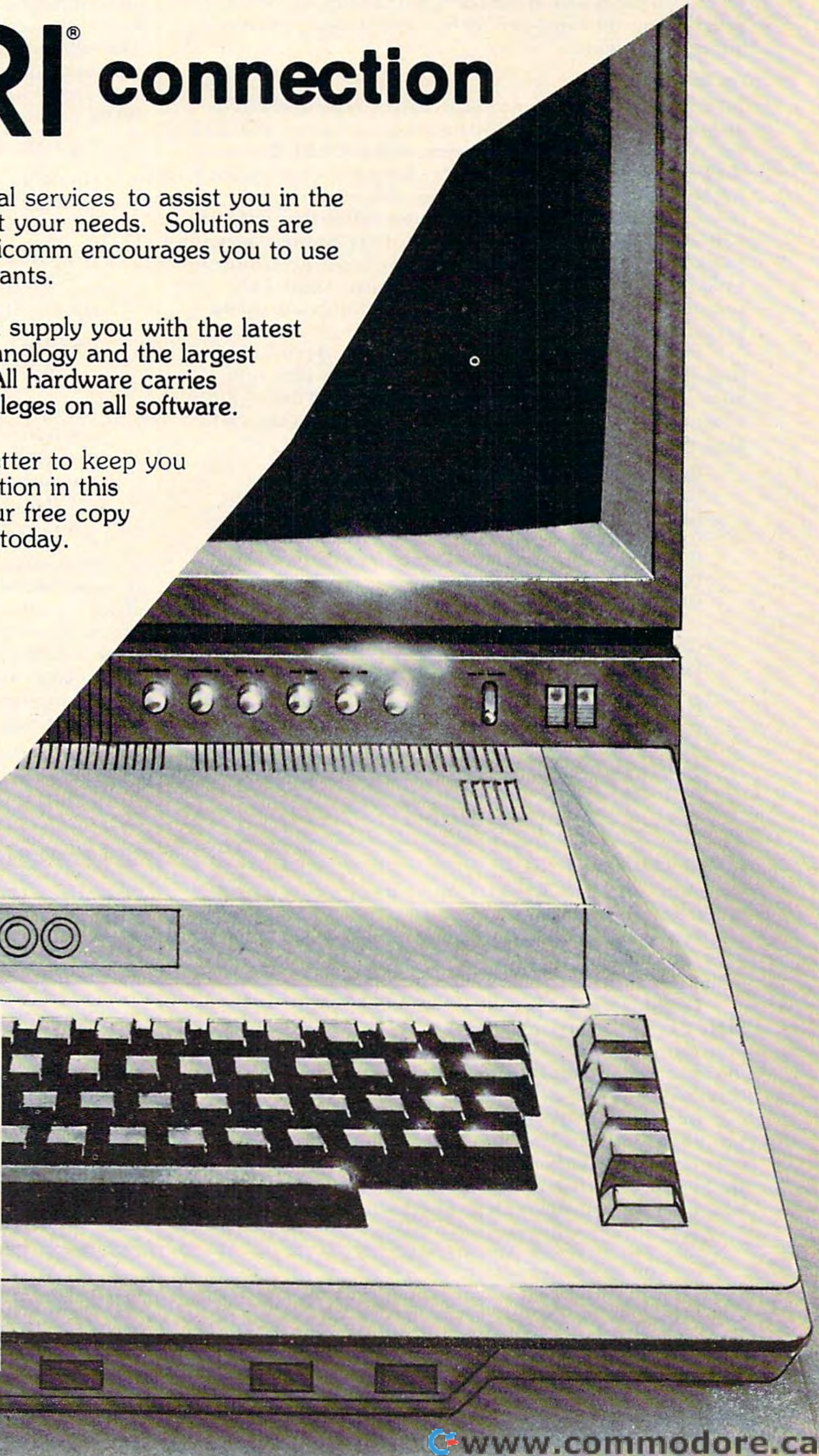

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COMPUTE!'s Listing Conventions

Many of the programs which are listed in **COMPUTE!** use special keys (cursor control keys, color keys, etc.) To make it easy to tell *exactly* what should be typed in when copying a program into the computer, we have established the following listing conventions.

For The Atari

All the editing and cursor control characters are spelled out and surrounded by brackets in the program listings: {CLEAR} for "clear screen." Other characters, such as CTRL-T (the "ball" character) will be listed as the "normal" character, but it will be within brackets: {T}. A series of identical control characters will be indicated by a number within the brackets: {3DOWN} means type ESC CURSOR-DOWN three times; {12 R} would mean type CTRL-R twelve times. Remember to press the ESC (escape) key before each cursor control key. If you should see {ESC} itself in a program listing, you would press ESC *twice*.

Two of the control characters, {=} and {-}, should be shifted. Any reverse field text will be enclosed within vertical lines. (In other words, any time you see a vertical line within a program listing in **COMPUTE!**, press the Atari logo key {⅄}.)

Atari Conventions

```
{CLEAR}= SHIFT-< (Clear Screen)
{UP}= CTRL-minus (Cursor Up)
{DOWN}= CTRL-equals (Cursor Down)
{LEFT}= CTRL-plus (Cursor left)
{RIGHT}= CTRL-asterisk (Cursor right)
{BACK S}= BACK S (Back space)
{DELETE}= CTRL-DELETE (Delete character)

{DEL LINE}= SHIFT-DELETE (Delete Line)
{INSERT}= CTRL-INSERT (Insert character)

{INS LINE}= SHIFT-INSERT (Insert line)
{ESC}= ESC (ESCape key pressed twice)
{TAB}= TAB (Tab key)
{CLR TAB}= CTRL-TAB (Clear tab setting)
{SET TAB}= SHIFT-TAB (Set tab stop)
{BELL}= CTRL-2 (Ring buzzer)
```

For PET/CBM/VIC

Generally, any PET/CBM/VIC program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor-down key; {3DOWN} would mean to press the cursor-down key three times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, S would mean to type the S key while holding the shift key. This would result in the "heart" graphics symbol appearing on your screen.

Sometimes in a program listing, especially within quoted text when a line runs over into the next line, it is difficult to tell where the first line ends. How many times should you type the SPACE bar? In our convention, when a line breaks in this way, the ~ symbol shows exactly where it broke. For example:

```
100 PRINT "TO START THE GAME  ~
    YOU MAY HIT ANY OF THE KEYS
    ON YOUR KEYBOARD."
```

shows that the program's author intended for you to type two spaces after the word *GAME*.

For The Apple

Programs listed as "Microsoft" are written for the PET/CBM, Apple, OSI, etc. Although the programs are general in nature, you may need to make a few changes for them to run correctly on your Apple. Microsoft BASIC programs written for the PET/CBM sometimes contain special cursor control characters. The following table shows equivalent Apple words. Notice that these Apple commands are *outside* quotations (and even separate from a PRINT statement). PRINT"[RVS]YOU WON" becomes INVERSE: PRINT"YOU WON":NORMAL

[CLEAR[(Clear Screen) HOME

[DOWN] (Cursor down)
Apple II +: Call -922
POKE 37,PEEK(37)+(PEEK(37)<23)

[UP] (Cursor up)
POKE 37,PEEK(37)-(PEEK(37)>0))

[LEFT] (Cursor left) PRINT CHR$(8);

[RIGHT] (Cursor right)
PRINT CHR$(21)

[RVS] (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the PRINT statement ends with a semicolon.)
INVERSE

[OFF] (Inverse video off) NORMAL

Shifted characters can represent either graphics characters or uppercase letters. If within text, just use the non-shifted character, otherwise substitute a space. Some "generalized" programs contain a POKE such as POKE 59468,14. Omit these from the program when typing it in. One final note: you will probably want to insert a question mark or colon within an INPUT prompt. PET/CBM and many other BASICs automatically print a question mark:

INPUT "WHAT IS YOUR NAME";N$
becomes
INPUT "WHAT IS YOUR NAME?";N$

All Commodore Machines

Clear Screen	{CLEAR}	**Cursor Left**	{LEFT}
Home Cursor	{HOME}	**Insert Character**	{INST}
Cursor Up	{UP}	**Delete Character**	{DEL}
Cursor Down	{DOWN}	**Reverse Field On**	{RVS}
Cursor Right	{RIGHT}	**Reverse Field Off**	{OFF}

VIC Conventions

Set Color To Black	{BLK}	**Function Two**	{F2}
Set Color To White	{WHT}	**Function Three**	{F3}
Set Color To Red	{RED}	**Function Four**	{F4}
Set Color To Cyan	{CYN}	**Function Five**	{F5}
Set Color To Purple	{PUR}	**Function Six**	{F6}
Set Color To Green	{GRN}	**Function Seven**	{F7}
Set Color To Blue	{BLU}	**Function Eight**	{F8}
Set Color To Yellow	{YEL}	**Any Non-implemented Function**	{NIM}
Function One	{F1}		

8032/Fat 40 Conventions

Set Window Top	{SET TOP}	**Erase To Beginning**	{ERASE BEG}
Set Window Bottom	{SET BOT}	**Erase To End**	{ERASE END}
Scroll Up	{SCR UP}	**Toggle Tab**	{TGL TAB}
Scroll Down	{SCR DOWN}	**Tab**	{TAB}
Insert Line	{INST LINE}	**Escape Key**	{ESC}
Delete Line	{DEL LINE}		

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COMPUTE! Back Issues

Here are some of the applications, tutorials, and games from available back issues of **COMPUTE!**. Each issue contains much, much more than there's space here to list, but here are some highlights:

January, 1981: Load PET Programs Into The Apple II, Player-Missile Graphics for Atari, The Atari DOS, The Kernel of the OSI Operating System, Fixing LOADing Problems on the PET, Spooling with the PET Disk, Expanding KIM.

February, 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on C1P, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

March, 1981: Machine Language Programming for Beginners, Getting the Most from your PET Cassette Deck, Apple and PASCAL, Flipping your Apple Disk, Designing your own Atari Character Sets, Renumber for Atari, An Atari Disassembler, Six-gun Shootout Game for OSI C1P, PET Machine Language Graphics.

April, 1981: How to be a VIC Expert, Resolving the Applesoft and Hires Graphics Memory Conflicts, Atari SuperCube, String Arrays in Atari, Memory Partition in PET, Pet Relative Files, Working with BASIC 4.0, Commodore File I/O, ROM Expansion for Commodore PET.

May, 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June, 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever- expanding Apple Power, Color Burst for Atari, Mixing Atari Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?

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August, 1981: Minimize Code and Maximize Speed, Apple Disk Motor Control, A Cassette Tape Monitor for the Apple, Easy Reading of the Atari Joystick, Blockade Game for the Atari, Atari Sound Utility, The CBM "Fat 40," Keyword for PET, CBM/PET Loading, Chaining, and Overlaying.

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October, 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleanly from Text to Graphics on Apple, Atari Cassette Boot-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.

November, 1981: SuperPet: A Preview, Japanese Micros: A First Look, Introduction to Binary Numbers, An Apple Primer, Page Flipper for Apple, An Atari Database System, A Program for Writing Programs on the Atari, Atari Textplot, OSI Relocation, The PET Speaks, Inversion Partitioning, A Personal News Service on PET, Bits, Bytes, and Basic Boole.

December, 1981: Saving Fuel $$ (Multiple Computers: versions for Apple, PET, and Atari), Unscramble Game (multiple computers), Maze Generator (multiple computers), Animating Applesoft Graphics, A Simple Printer Interface for the Apple II, A Simple Atari Wordprocessor, Adding High Speed Vertical Positioning to Atari P/M Graphics, OSI Supercursor, A Look At SuperPET, Supermon for PET/CBM, PET Mine Maze Game.

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Called the SoftBox, HardBox, and Petspeed compiler, these enhancements bring the benefits of the widely used CP/M operating system, Winchester hard disk mass storage, multi-user capability, and high-speed BASIC compiling to all PET and CBM microcomputers.

• The SoftBox permits Commodore users to run the hundreds of CP/M compatible applications packages, as well as interface with up to four Corvus Winchester hard disk drives. RS232 interfacing capability is also included.

• The HardBox, teamed one to a computer, will allow up to 64 users to access simultaneously the same Corvus hard disk storage – up to 80 Mbytes using the Corvus Constellation multiplexer.

• The Petspeed compiler allows Commodore BASIC programs to run up to 30 times their normal interpretive speed. The software includes optimization procedures that permit faster execution than other compilers.

The SoftBox, containing a Z80-based 64K RAM board, modifies the CP/M operating system for the Commodore disk drive, using the PET or CBM computer itself as a terminal. CP/M version 2.2 software is included, and runs at 4MHz with no wait states, for rapid execution.

A proprietary SoftBox system utility called NEWSYS gives users much latitude in reconfiguring the operating system for their own requirements. Menu-driven options include disk drive, I/O, and RS232 assignment, as well as allowing the computer to emulate a Lear Siegler ADM3A, Televideo 912, or Hazeltine 1500 terminal.

Small System's HardBox device enhances the PET disk operating system (PET DOS versions 1 or 2), allowing one to four Corvus drives to emulate the Commodore floppy disk unit for up to 64 users.

Seven HardBox utilities are also included: user reconfiguration, password security, file transfer between hard disk and floppies, diagnostics, and use of a video cassette as a backup device.

The Petspeed compiler uses a four-pass algorithm that gives priority to frequently used variables, removes unnecessary code, and utilizes integer arithmetic wherever possible. In addition to its fast execution, the compiler is available with unrestricted use. Software writers may sell their compiled programs without incurring additional royalties.

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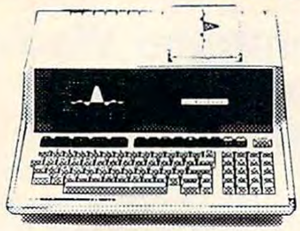

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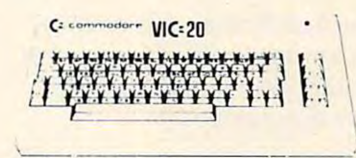

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The SoftBox and HardBox systems are respectively priced at $895 and $695. The Petspeed compiler lists for $350.

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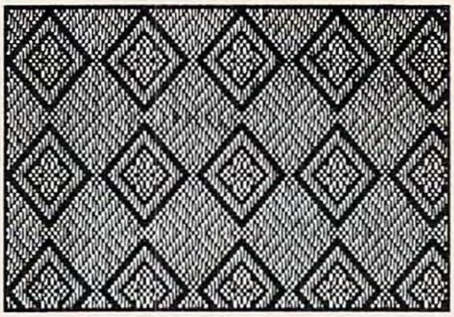

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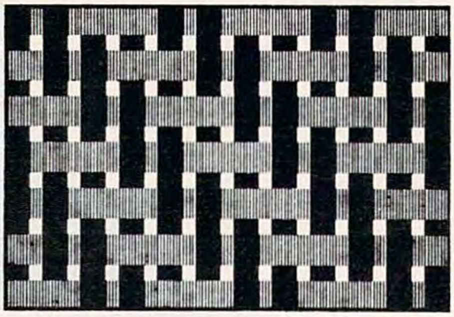
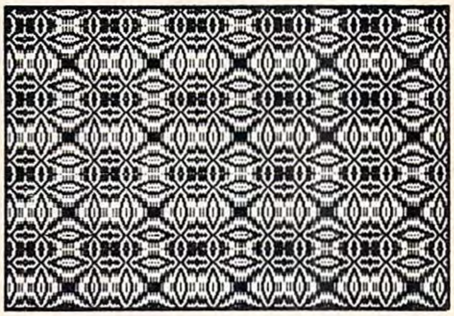


Englarged View of a Four Harness Twill



Four Harness Overshot Pattern

lished, the computer draws a full color television picture of the design. The designs can be saved on small, inexpensive (and reusable) magnetic diskettes. The design images can easily be photographed if color slides or polaroid pictures are desired.

The original Video Loom program, released in early 1979, was the subject of a special exhibit at the 1979 Conference of Northern California Handweavers' Guilds. At the Lawrence Hall of Science, in Berkeley, California, it was used to introduce teachers, textile hobbyists and designers to the principles of computer aided design. For more than three years it has been enabling weavers to preview their designs before going through the time consuming process of warping and creating samples.

The new version features fast machine language routines for weaving and drawing, and a foolproof screen editor for setting up the loom. This means that weaving is 20 to 30 times faster than with the original program and that designs can be changed more easily than ever.

Video Loom II simulates a 32 harness loom with 64 treadles. The loom can be instantly changed from rising to sinking shed. Designs can be displayed in up to six colors (including black and white).

In addition to choosing a threading draft, tieup and treadling, the program allows the weaver to vary warp and weft colors, thicknesses and the spacing between threads. This makes it possible to create design images that look very much like

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photographs of woven textiles. Alternatively, by using very thick threads and wide spaces, a "magnified" view of a textile can be created. This feature can be used by teachers to realistically display and compare the structures of different kinds of weaves.

The program has a mode that permits the weaver to use the computer's keyboard keys as treadles. In this way, a design can be developed one weft at a time, just as if a real loom were being used.

During a weaving session, all, or only some, of the design elements can be saved on reusable, magnetic diskettes. Any design element that has been saved can be recalled at any time. This permits, for example, the tieup or treadling from one pattern to be combined with the threading draft from another, without typing in any new data.

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Hardcopy printouts of the draft, tieup, treadling and all other design elements are available. If the computer is equipped with the proper accessories, a graphics printout of the design images can be obtained at the touch of a key.

Video Loom II requires a 48K Apple II+ (or an Apple II with Applesoft in ROM or a Language Card) and one disk drive. It comes on a DOS 3.3 diskette with complete, easy to follow instructions.

The cost is $59.95 plus $4.00 for postage and handling. Overseas orders should be paid in US currency and require $10.00 for postage and handling.

A brochure can be obtained by sending a stamped, self-addressed envelope.

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Atari 800 And 400 Computers Now Able To Handle Many Personal And Business Applications

A new family of intelligent interface modules from Compu-Mate will enable the Atari 800 and 400 personal computers to accomplish many additional personal and business applications which, until now, were beyond the computers' capabilities.

The first member of the new family is the Model CM-1000 printer interface. This unit includes one EIA standard serial port (standard synchronous protocol) and one 8 bit parallel port (Centronics compatible). Both of these ports are for use with standard serial or parallel printers, including letter quality.

The unit comes with a simple customization program that allows the user to tailor special control codes for each port for use with many popular printers. The Atari 800 and 400 computers no longer need be limited to use with the Atari 825 or Epson MX 80 and 100 printers. Additional features include: standard baud rates from 300 to 38,400, bi-directional communications for use with modems, etc; software selectable port addressing; automatic powerup compatibility with the Atari 825 printer on the parallel port, and Diablo compatible printer on the serial port.

The second member is the CM-1000/V. This unit includes the CM-1000 printer interface described above. In addition, it includes an 80-column video display generator. This generator enables the 800 and 400 computers to perform many functions such as full page width word processing and other tasks requiring an 80 column instead of a 40 column display. This display generator includes many other advanced features normally found on more expensive terminals. Additional features include: connects directly to the 800 and 400 video monitor ports; software selectable 80 or 40 column display; full 96 ASCII character set; upper and lower case characters with below the line descenders; reverse video; software downloadable character set; compatible with any video display capable of 80 columns.

Features common to both

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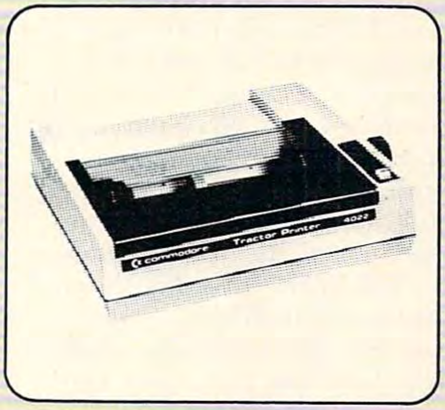

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interfaces include: no physical changes to computers required; both interfaces connect directly to the computers' standard serial I/O port; no cables to kludge out of the computer; both operate under DOS 2.OS and future DOS versions. One year warranty.

The CM-1000 is priced at $289.00. The CM01000/V is priced at $489.00. A kit, (Model CM-10/V) to upgrade the CM-1000 to the CM-1000/V (adds video display generator) is available for $225.00.

For additional information:

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Cash Register Inventory System From Adventure International

C.R.I.S. (Cash Register Inventory System) is a complete software package that converts an Atari 400 or 800 into a point-of-sales terminal.

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Graphics Package For The VIC-20

Abacus Software announces the availability of GRAPHVICS which gives the VIC user both HiResolution and Multicolor display modes.

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GRAPHVICS adds 18 commands to VIC BASIC – commands to set colors, plot points, draw lines and rectangles, and display text on the graphics screen. The commands are simple to use and make programming in BASIC with GRAPHVICS easy.

GRAPHVICS is interactive allowing you to type the commands at the keyboard and watch the graphics immediately appear on the screen. Furthermore, GRAPHVICS allows you to save any of your screen displays to tape or disk. You can restore those saved displays for viewing at a later time.

GRAPHVICS will run on any VIC that has either a 3K or 8K expander. It comes on cassette or diskette with the user's manual and sample programs.

Price is $25 in the US and Canada, $30 elsewhere. Postage is included.

Abacus Software
P.O. Box 7211
Grand Rapids, MI 49510
(616)241-5510.

Insoft Announces GraFORTH: An Apple II Graphics Language

GraFORTH is a graphics programming language for entertainment, educational, and other graphics software creation. Designed for novices and professionals alike, GraFORTH features fast 3-D color animation graphics including rotation, scale, transposition, and perspective. Character set graphics are also included with full color, variable character sizes, upper and lower case text entry, and a block print command for easy manipulation of large shapes. Lines are drawn much faster than in BASIC and colored lines are never broken. Turtle-graphics are included to rapidly draw line shapes at any angle. In addition, GraFORTH has a software-based music synthesizer for adding music or sound effects to your programs. Music can be played in any one of several possible instrument voices.

GraFORTH is highly structured, providing easy-to-read code and programs that are fully compiled to machine language for fast execution. A 220 page tutorial manual provides complete descriptions of the program's operation.

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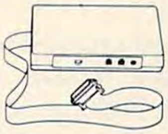

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The schedule for Friday includes numerous workshops, field trips, school visitations, and a keynote speaker at a banquet dinner; participation in all events is by pre-registration only.

The schedule for Saturday includes over 100 commercial exhibits, as well as workshops and six hour-long sessions covering many varied computer-related classroom activities. Curriculum topics will include all levels of education from pre-school through post-secondary, and will cover a broad range of applications of interest to the novice and the experienced computer user.

Computer-Using Educators is a non-profit corporation founded in 1978, with over 3000 member-educators in all but five states. More information concerning membership or the Conference can be had by writing to:

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Twenty-four magazines are indexed in the 1980-81 special edition of *The Periodical Guide for Computerists.*

The "Computerist" is extensively cross-referenced, easy to use and lists major articles, product reviews, editorials and miscellaneous items published in 24 computer and electronics magazines in 1980 and 1981. Over 10,000 entries are included in the latest edition of the "Computerist" which retails for $11.95.

The "Computerist" index was first published in 1976 by Berg Publications of Bothell, Washington. ACE, the new publisher, is a small publishing firm located in rural southern Oregon, using a NorthStar microcomputer to compile and generate index publications.

ACE is issuing the double 1980-81 edition of the index as its introductory edition. ACE expects to publish the index annually and to add to the number of magazines listed in future editions.

More information and copies of the 1980-81 "Periodical Guide for Computerists" at $11.95 and back issues of the "Computerist" at $5.00 each are available from:

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Columbus, Ohio – The Canadian Press (CP), Canada's national news-gathering cooperative, announced in Toronto the availability of its Business Information Wire through the computer facilities of the CompuServe Information Service.

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Talmis will be publishing the first of its annual multi-indexed reference guides to microcomputer courseware for K-College education. The index will list more than 900 programs by courseware title, topic, style, grade level, running time, publisher, price and availability by computer and by format (disk, cassette, etc.). It will also indicate related print or A/V materials and basic hardware requirements. Most importantly, it will reference software reviews published in major educational or software magazines so that teachers may compare qualified critiques of programs which interest them.

For convenience, the courses will be indexed by topic, by grade level and by publisher.

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Software Arts Establishes Data Interchange Format

Software Arts, Inc., the creator of the VisiCalc microcomputer program, has established a standard for exchanging data among personal computer programs by making available DIF, a data interchange format. The DIF format was originally developed by Software Arts for use with the VisiCalc program.

Software Arts has also created a DIF Clearinghouse to provide the technical information necessary for other program developers to access DIF format files with their own application programs.

The DIF format, already supported by a variety of commercially available programs, eliminates the need for time consuming re-entry and modification of data that was previously required. For example, DIF is invaluable where several different programs use the same information for financial planning, billing, and inventory. Another advantage of conforming to the DIF file format, and a major goal in its design, is the ease with which it can be used by novice programmers as well as experts.

The DIF file format has sufficient power for many applications, is easy to use and understand, and is independent from the features of any one particular computer. It also is independent from any one programming language: DIF files may be used with any language. Some of the programs currently available that can use DIF to share data with one another include VisiPlot, VisiTrend/VisiPlot, CCA Data Management System, TrendSpotter, DB Master, and most versions of VisiCalc. Other supporting programs are planned

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Software Arts established the DIF Clearinghouse to coordinate and distribute information about DIF and the commercially available programs that use it. Anyone adopting DIF will have his or her program added to the list of DIF-compatible programs if they notify the Clearinghouse. Additional information about DIF, including the technical specifications and list of programs supporting DIF, is available for $6.

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CAPUTE!: Corrections And Amplifications

1. "Using Textplot for Animated Games," April, 1982, #23, pg. 146: Because the character set is not located on a 1K boundary, any error messages will not make sense. The program will work as printed, but mistakes made during typing will not be easily understood because of the nonsense "error messages." To avoid this, you can relocate the address of the character set by these changes: Line 20 POKE 756,PEEK(106) and change line 32000 START=PEEK (106)*256.

2. "Micromon," January, 1982, #20, pg. 160: The following helpful relocating information and an associated modification to Micromon came from R. Lewsey of the Cossor Computer Club, Harlow, Essex, England.

We initially used the N command parameters in the published example but subsequently found that the code cannot relocate itself in situ – only a copy of itself made using the transfer command. The commands we eventually succeeded with after fixing the bug (see below) were:

```
.T 1000, 1FFF,2000
     Copy Micromon to $2000-$2FFF
.N 2000,2FFF,1000,1000,1FFF
     Relocate code
Relocation stops on an unrecognized code
.N 2FB0,2FFF,1000,1000,1FFFW
   Relocate word tables
```

[*To test the relocated version, first Kill the Micromon you're in (at $1000) then .G 2000 will initialize the relocated version – Ed.*]

The following changes were made which correct the N command, but slightly change the syntax of the command for word table relocation. The W at the end of the command should immediately follow the fifth address parameter; there must be no intervening space.

```
1770 A9 00       LDA #0
1772 8D 8C 02    STA $028C
1775 20 06 10    JSR $1006
1778 EA          NOP
1779 EA          NOP
```

It may not be obvious to some readers that downward relocation may also be achieved by using a suitable value for the third parameter. Subtract the required offset from $10000 (yes, four zeroes) to give the necessary parameter value (e.g. $E000 moves the code down by $2000).

I hope this information will be helpful to other Micromon enthusiasts and would like to thank Ron Cason for his assistance in sorting it all out. ©

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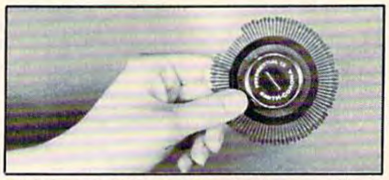

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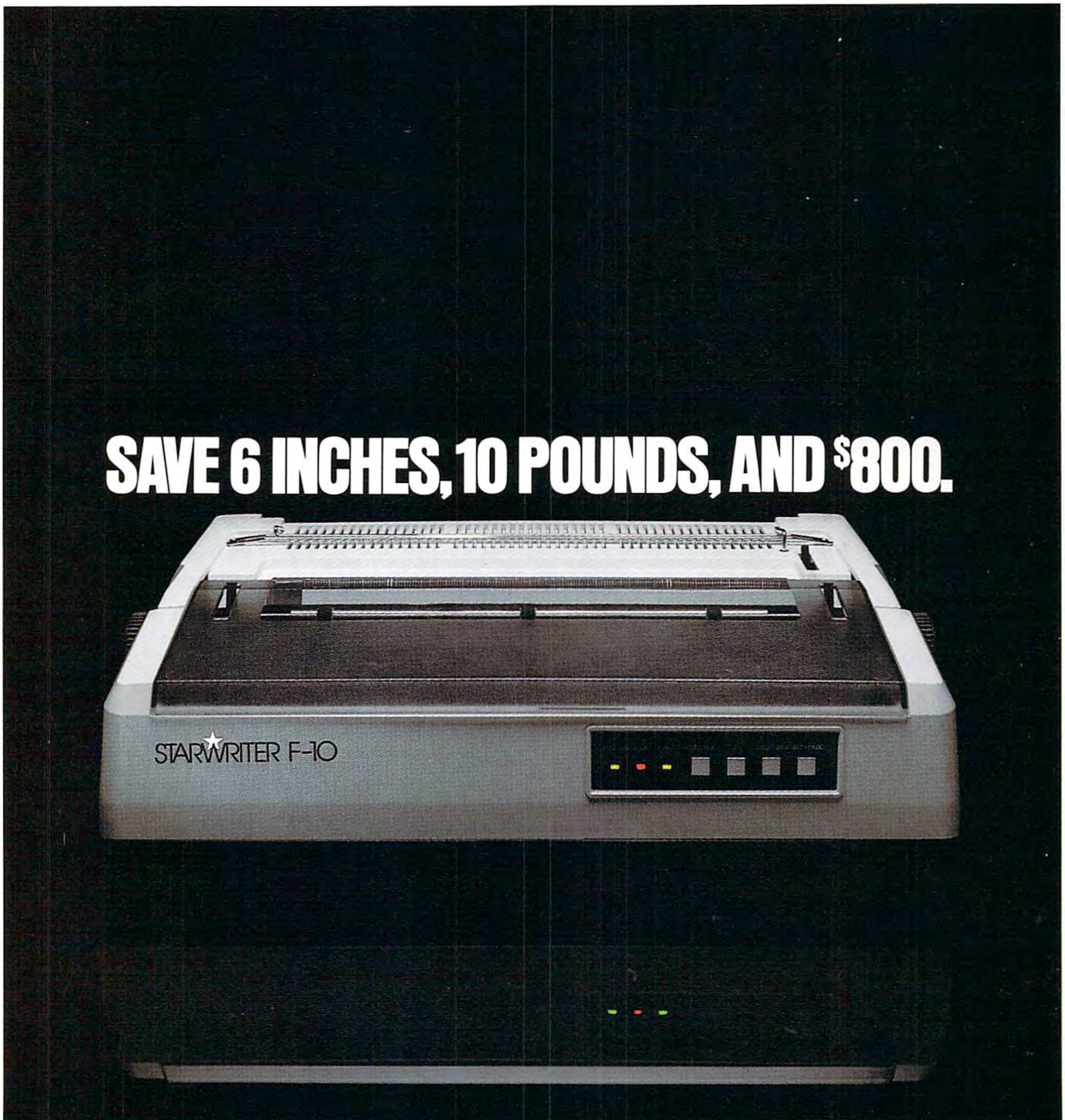

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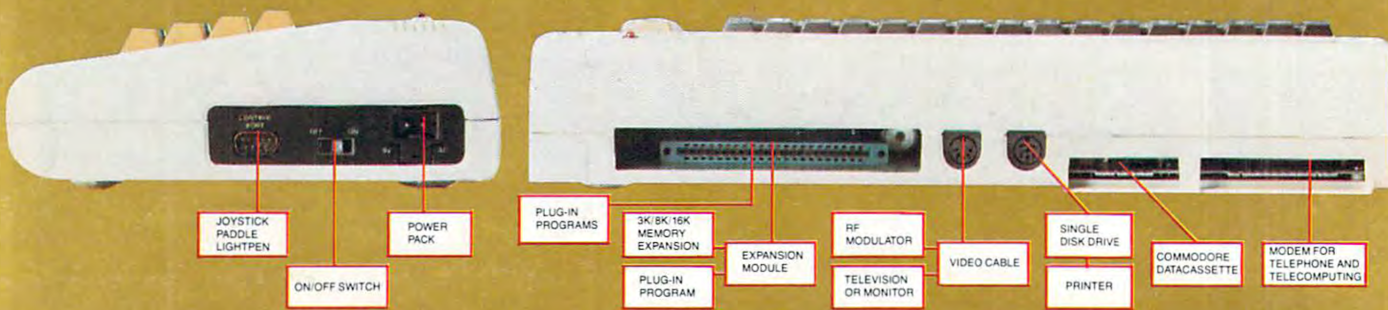

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