PET User Notes

Publication of the PET User Group Box 379 South Bound Brook, NJ 08880

VOLUME 2 ISSUE 1 **PRICE $1.50**

TWO-HEADED EDITORIAL

Effective with this issue, the User Notes is operating with additional editorial and administrative help, which will enable us to keep to a more regular publication schedule.

Since we are starting our year so far behind, we will publish the Notes on roughly a six-week cycle, which will have us caught up by the end of the year.

The new help is in the form of Roy O'Brien, who has been active with the New Jersey Computer Club for the past three years. Roy will be responsible for the administrative end of things, including handling the mail and subscription activity, as well as picking up part of the editorial function.

Gene Beals will remain involved in the work of editing, and will also continue to operate the Tape Exchange Program.

In the past year, it has been very gratifying to see, in spite of the relatively meager documentation from Commodore, the emergence of sophisticated programs and routines for the PET. It's a remarkably potent little machine, and we're looking forward to further software development.

At the same time, each month we hear from new subscribers who have just bought a PET, and are in need of beginner-level information to get up-and-running.

To accommodate both the advanced and the neophyte PET owner, Gene and Roy are sharing the editorial work on the basis where Gene is mostly concerned with the advanced group, and Roy will see that the newcomers are not neglected. However, we work closely together, and mail may be sent to either one; the most important thing being that two people are (or ought to be) more effective than one.

We are strong believers in the need for an independent forum for PET owners to exchange information and ideas, and publish their work. Although we are more than pleased with the number of people who have written and submitted items for publication, we would like to repeat that all material is welcome...remember, regardless of where you are on the experience curve, there are others who can benefit from your work, and vice-versa.

Correspondence with individuals and PET groups is a vital part of this activity, and newsletter exchange is invited. If there is no group in your area, and you would like to start one, or contact other PET owners, send a postcard and we'll print an announcement. If you have any questions, let us know—it's a big help in trying to decide what to include in the Notes.

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PET User Notes is published 6 times a year by the PET User Group, Box 379, South Bound Brook, New Jersey 08880.

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NEW COMMODORE PRODUCTS
A QUICK REVIEW *Gene Beals*

As most of you know by now, many of the new PET products are being delivered. My understanding of current status is as follows:

PET 2001-16 is available in two models—one with a full-size keyboard (with cassette deck external and optional), and the other with the small keyboard and cassette built-in. Price is $995.

PET 2001-32 is also available in the same two configurations at $1295.

The PET 2040 Dual Disk is available in limited quantities at a price of $1195. A model 2040A was just announced (July availability) as a single drive version with the same cabinet and controller board at #$895. Addition of a second drive will be possible for approximately $400. The previously announced 2041 Drive has been cancelled (the unit was to attach through memory expansion connector rather than IEEE as 2040 does). While the 2040 models will operate with 8K machines as well, the new ROM set to allow the connection will not be available until about July (the ROMs are to be included in the price of the disk drive, however).

PET printers should be available in May (the 2023 Pressure Feed about mid-month at $849, and the 2022 Tractor Feed at month-end for $995). The 2021 Electrostatic Printer was cancelled.

Aside from the outward appearance of the full keyboards, the new models have a number of operational differences compared to the 8K unit. All the previous bugs and idiosyncrasies seem to be corrected, and additionally there are several enhancements.

Accesses (PEEK or POKE) to screen memory no longer generate snow.

RND(0) and RND(1) appear to be seeded by the timer, since values are random when first called after power-on.

When lower case is enabled, the shift operates as on a standard typewriter (shift provides upper case). Case shift on the screen however, is a function of the character ROM, so that when going to an alternate device (a printer), upper and lower case are reversed.

The signal which blanks the video on the 8K is not connected on the newer models, so POKE 59409,52 no longer works (ROM routines still use the address, however, causing a line scroll).

NMI Vector is initialized to BASIC "warm start".

When output is directed to an alternate device, the ASCII "space" code ($20) is used for all BASIC-supplied forward spacing. This means that TAB, ";", and "," will provide proper spacing on your printer.

PEEK address range is no longer restricted.

Execution of some code seems to be slightly faster due to more efficient programming and better use of page 0.

Screen print is faster because extra code to maintain separate POS pointer was removed.

Cursor home, up, and down are now tracked properly by POS.

Machine Language Monitor is in ROM, and the BRK vector is initialized to point to Monitor (SYS 1024 gets you there). The MLM code is a little more compact, and Save and Load have revised syntax.

Operating system addresses for the new models have been changed extensively. Almost all locations in low memory (pages 0, 1, and 2) are different, with the exception of the cassette buffer areas. The new manuals which come with the PET 16 and 32 have a complete memory map for this area.

ROM routines, while essentially the same, have been reassembled to incorporate changes and corrections. Almost all segments are in slightly different locations. (If anyone needs a copy of the revised ROM addresses, send me a note. I have a list compiled by Jim Russo in which the new locations are listed in parallel with the old on a map previously identified by Jim Butterfield.)

I'm certain many people will be slightly upset by the address changes in both low memory working storage and the ROM area, since many programs made extensive use of these locations. If you programs have decent documentation, address changes should be relatively minor. If you purchased some of the "commercial" programs which are not documented or have deliberately unexplained code, you are at the mercy of the vendor.

A few programs will be difficult to convert regardless of documentation.

Standard PET BASIC programs should run with no changes (PEEK and POKE into areas other than screen memory are generally non-standard). If you're still concerned, remember the admonition of the large system people: use only standard language implementations (i.e. FORTRAN IV, ANSI COBOL, etc.) unless you want to be hardwired to a particular piece of hardware.

Several changes inside the new machines are apparent also. The revised main logic boards use dynamic RAM. The 16K uses 4108, while the 32K has 4116 (or equivalent) chips. Both boards are fully populated, and it doesn't look as though you can upgrade 16K to 32K with a chip change. Video RAM is static and uses the MOS 6224 (2114) part.

The memory port connectors are .1" on center 'spectra-strip" style. Pinouts are described in the manual (which has already been updated and reprinted). Two new power connectors are included on board to provide power for "daughter boards".

The 2040 Dual Disk appears to be quite powerful and flexible. Usable capacity is 171,500 bytes per drive (343,000 bytes on line).

The controller incorporates a 6502 and a 6504, as well as 4K of static RAM (2114). The processors apparently watch over head, track, sector position, buffer management, and data transfer on the IEEE bus.

My use of the disk to date has been limited to moderately simple operation—SAVE, LOAD, and sequential data files. Random Access file capability is incorporated in the 2040 design without leaving BASIC (a sample program is included in the preliminary disk user manual.

One final note: Jim Butterfield suggests there be an "official" designator for new ROM machines, since existint PETs may also be upgraded with new ROM. This would make it easier to annotate listings for programs using any of the changed addresses.

Hope the review helps. Special thanks to Jim Russo for the stack of notes he sent, and for the new ROM address list. Again, if you need a copy of the Russo (new ROM)-Butterfield (old ROM) list, send a SASE and one boxtop from your 32K PET to Box 371, Montgomeryville, PA 18936.

PROGRAMS ON TAPE

Partial list follows -- send for complete list.

The "programs on tape" service and exchange functions as a low cost method for software distribution. The copying cost is $1 per program. We can put up to 4 programs on a C-10 tape, or 12 on a C-30 tape. Please add $1 per tape (either C-10 or C-30) to cover tape cost and postage within U.S. or Canada. If any written documentation is available, a copy will be included with the associated program.

At this time we are behind on getting programs copied onto tape and returned to you. We just re-acquired a person who indicated willingness to endure the drudgery of saving programs, so we'll be catching up in the near future.

If you have a program to contribute to the list (one which we don't have, or an updated or enhanced version of an existing program), please send it on tape. We will save it for the exchange and return a program of your choice. Again, due to space and time limitations, only a partial program list (primarily some of the newer programs) is included. Write us at PO Box 371, Montgomeryville, PA 18936 for requesting programs and for the complete list.

Among the new 2programs are several by Mark Zimmermann (Caltech 130-33, Pasadena,CA 91125). Some of these have been, or will be published in the various micro magazines. Mark granted permission to include the programs in the exchange -- but you might want to acquire the various publications for more complete documentation.

TINY ASSEMBLER -- Mark Zimmermann - Personal Computing 12/78

MAZE MODULE -- Mark Zimmermann - inclomplete, but could be used as nucleus of game.

GAS -- Mark Zimmermann - machine language module for physics simulation to be published in BYTE.

GAS DRIVER -- Mark Zimmermann - BASIC driver for GAS.

BLACKBOX -- Mark Zimmermann - Parker Bros. game. Try to locate position of 5 balls in box by shooting probes into box.

INTERMOD -- Bill Stinson - IM calculation program for hams or communication techs.

ACTIVE FILTER -- Bill Stinson - Design program adapted from IBM library.

FREQUENCY COUNTER -- Bill Stinson - Basic 3 digit counter - will include copy of Bill's interface and connection to parallel port.

KLINGON CAPTURE -- Mark Turner - grid game from KILOBAUD

SIMON -- Gary Mayhuk - sound repetition game

OTHELLO/2 -- F. Dunlap. Modified by J Mendenhall

DIGIT SPAN -- number recall in sequence and reverse sequence for progressively long numbers

CENTRAL LIMIT -- Dave Heise - graphs results of repeated samples of any given size, showing averages tend to be normally distributed.

CHI SQUARE -- Dave Heise - constructs repeated random 4-fold tables and computes significance test for each. Nice graphics representation of statistical values

MONEY CHANGER -- Max Yoder - give correct change for amount shown. Basis of a good educational program. No graphics.

BABY -- Sally & Stan Klein - try to keep your sanity while feeding & diapering your baby yet have time to yourself

SAM -- R.Tansony - shoot down enemy planes from your missile base

CHECKERS -- William Anderson

PET ORGAN -- Wm. Anderson - Sound plays 3 octaves of notes

STARWAR -- John Ball - save planet from enemy fighter planes. 10 levels of difficulty.

LONG DIVISION -- E Lichten-long division tutorial by grade level

NEAT PROGRAM -- Chris Crawford

TANKS -- E.Lichten - shoot Russian tanks which are faster & able to move through the mine fields

FAIR OPTION VALUE-- Joe Kot - Evaluate stock option prices.

TRACE -- Brett Butler-traces basic program or direct entries

KEYBOARD -- Neil Harris/J Butterfield - musical keyboard, will remember and play back tune

MARKS -- J Butterfield - keeps track of names and grades, shows low, high, and average. Keeps tape file.

PORTFOLIO -- J Butterfield - keeps track of stocks. Buy sell, evaluate, and save on tape.

MERGE -- J Russo/H Chow - merge two or more program segments

M7171 -- J Russo/H Chow - high monitor with merge capability

IMAGE -- P Rowe, modified by H Chow - save any portion of memory on cassette

TIME/COORD -- Adolf Futerweit - for sky watchers, provides the necessary calculations to prepare for a night of observing or program planning. Uses 2 cassettes. NOTE: this has 2 programs & extensive documentation and will cost $3 instead of $1.

DEBUG -- E Blaschke - poses a programming problem regarding floating point calculation, asks you to debug, and provides solution (if you give up).

MT6671 -- Jim Russo - excellent version of high monitor and disassembler with single step capability.

ASSEMBLER -- Mark Zimmerman - quick assembler with tape object code save and load capability.

BLACKBOX -- Steve Michel modified from Creative Computing - guess location of atoms in space

QUARTIC -- W.Hawes - solves quartic, cubic, and quadratic equations.

BAIRSTOW -- W. Hawes - solves Nth order polynomial equations.

COMPLINEQN -- W. Hawes - solves linear equations with complex coefficients. Uses a modified Gauss-Jordan elimination method.

TANK WARS -- Ralph Bressler - 2 player tank fight game.

EXAGON -- Mac Ogelsby adapted by James Parsly - puzzle game for you to learn by playing. You against the Computer.

SAND PILE -- Mac Ogelsby adapted by J.Parsly - try to get a sand pile level without losing any sand.

LINE MAZE -- Frank Tyniw - adaptation of Andy Fraley's short maze with sound. An obstacle course one player game.

AFO -- Japanese program with phenominal graphics and animation.

TOKER -- anonymous Michigan User (of PET) - excellent graphics. This program will be an underground classic.

SOUND DEMO -- CAP Electronics - program is an advertisement but still a nice demo for CB2 sound.

ARROW -- J Butterfield - in Volume 1, Issue 7

ELEMENT DRILL -- Richard Larson - intro for beginning chemistry students on element abbreviations

IONIC DRILL -- Richard Larson - for beginning chemistry students on chemical symbols and ion charge.

FILE & SORT -- enhanced version of filing and record retrieval system.

BASE -- F Campbell - convert from one base to another

STICKS ON HILL -- super graphics demo

OPTICAL ILLUSION -- super graphics demo

1000 MILES -- F Covitz - computer version of Mille Borne. It's very addictive.

ORDINARY DIFFERENTIAL EQUATIONS-1st & 2nd ORDER -- Karlheinz Lehner - computes approximate ordinates to the solution curve given boundary values by a Runge-Kutta method

KNIGHT'S TOUR -- F Chambers - solution to classical chess puzzle, PET graphics and animated gimmicks

PETALS AROUND THE ROSE -- Wm Rothanburg - clever puzzle

FRACTION -- Don Johnsón - educational game to teach fractions

TI FIGHTER -- with sound

TAPESTRY -- Frank Chambers - pattern generator using a couple of the symbols hidden in lower case.

PINBALL -- Bruce Jaeger - good graphics and sound.

DISASSEMBLER -- Karlheinz Lehner - Disassembles machine code in KIM (MOS Technology) assembly language.

CALENDAR -- Ernest Blaschke - draws a calendar of any month & year from 1904-2099.

UNIT CONVERSION -- Ernest Blaschke - converts weight, distances, time, pressure, tempurature (metric or imperial)

Letter from Frank Covitz

Dear Gene,

On January 21, 1979 at approximately 3 pm, I witnessed what may have been a unique event. For the first time, I believe, I saw a demonstration of the capability of controlling individual pixels on the PET screen!!

As you know, the PET screen normally allows a display of 1000 characters, each within an 8 x 8 pixel matrix. This comes out to a display format of 320 horizontal by 200 vertical pixels, or a total of 64,000 pixels. However, because of the way the operating system manages the video (1K bytes of screen RAM plus character generator ROM), the user can only access by characters available on the keyboard. I have often thought how desirable it would be to have control over each of the 64,000 pixels. I can now state that it can be done!!

The key is an elegant piece of hardware called "visible memory" (VM) designed by Hal Chamberlin and Dave Cox of *Micro Technology Unlimited (MTU)* - the same people who gave us the 6502 4-part harmony music software and DAC/filter/audio amplifier board. The VM is essentially an 8K dynamic RAM board but with the following feature - During the phase 2 part of the clock cycle (when the 6502 does not use the address bus) the dynamic RAMS are refreshed and at the same time a video signal is generated. To the 6502, the system behaves like 8K bytes of RAM. However, the video signal (when displayed on a monitor) allows the user to see every bit of every byte. Unlike the PET internal video, the VM does not have any "snow" on it during read or write operations.

The VM, at present, needs an interface card to get the proper addressing and to permit the use of the PET video monitor with VM. The January 21, 1979 date mentioned above was the day I brought my PET to MTU headquarters in Manchester, NH. After Hal Chamberlin got a look at the PET circuit board with a 'scope, he was quickly able to put together an interface breadboard which compatibilized the VM to the PET. The VM can be turned on via a hardware switch or, better yet, under control of an unused I/O port. This allows *software* to select either VM or PET video. The people at MTU are at present designing a finalized board for interfacing PET with VM. They may very well have this completed by the time this letter gets out, so I would definitely write them for info and pricing. Their address is:

Micro Technology Unlimited
P.O. Box 4596
841 Galaxie Way
Manchester, NH 03108

With care, the VM and interface can be fitted *inside* the PET.

MTU's hardware and supporting software is, as far as I am concerned, superb. Although designed mainly for KIM-1, their products should run on most 6502 based products, i.e., the PET. If their PET market grows, they will undoubtedly consider PET-specific hardware and software.

With a little bit of programming effort, I have already converted Hal Chamberlin's VM *Life* software to run on the PET, including the clever demo where the word "Life" is drawn on the screen and the system then applies the *Life* algorithm to it. A winking cursor. cursor control keys (including CLR), pause, and return to BASIC are supported in the PET modified version. Each generation takes about 4 to 6 seconds to complete, super fast when you consider that 64,000 bits are involved!!

With the PET being a video oriented machine, I predict that VM will open up a whole frontier in software - games with true animation, high resoltution graphics, special character fonts, etc. Please spread the word.

F. Covitz

Ed. Note; The Visible Memory and interface Frank describes were exhibited by MTU at the Trenton Computer Festival and really drew a crowd, including some surprised and curious Apple *owners. With this add-on, you can run high resolution graphics or return to the regular* PET *character set and have an additional 8K of RAM available for programs. MTU's ad on p. 23 gives an idea of what this display can do. —O'B*

Sawyer Software

Business Software for your 8K PET tm

★★★ NEW ★★★

ACCOUNTING PACK 1 —
Accounting Pack 1 is a general ledger package designed for small businesses and homeowners. It contains check journal, general ledger, income statement (current ytd, previous month ytd and current month), balance sheet (current month and previous month). There are 15 commands and 6 reports that can be generated. The system uses an unique single-entry bookkeeping system and can hold up to 50 entries per period (month, week, day) and up to 40 different accounts. Each period's data is kept on convenient cassette tapes. Utilizing the general ledger command the user can view the general ledger entries for the month from Assets to Expenses or stop in midstream and view one particular account. Or the user can type in an account name such as "Advertising" and view the entries for that month. The Accounting Pack 1 program includes a checkbook reconcilation routine which aids in finding checkbook errors. **Sawyer Software** plans updates to Accounting Pack 1 to enable the user to use a printer, floppy disk or more memory. Accounting Pack 1 is well documented, with a newly updated User's Manual. Several businessmen are using Accounting Pack 1 and have written to us their satisfaction with the program along with their purchase of other software.
.... **$25.00**

SCHEDULE PLANNER —
Schedule Planner can be used by secretaries, receptionists, housewives or anyone wanting to plan and have at their fingertips their own schedule. Data entered is data: time, priority and description. The commands allow the schedule to be shown for a particular day, request of time or the "viewing" of appointments according to importance.
.... **$15.00**

SCHEDULE PLANNER #2 —
Schedule Planner #2 includes all the features of Schedule Planner, but is used for one or more individuals. Utilizing Schedule Planner #2 a customer can call in asking when his appointment with Dr. Jones is and in seconds the receptionist can give the date and time. Or Dr. Jones can find out his schedule for the day. With the viewing command, an appointment at 12:00 on a particular day will display on the screen at that time allowing receptionists and secretaries to validate appointments.
.... **$20.00**

COMING SOON —
Business Software for your 16K TRS-80. Write or call for details and availability.

Dealer inquires invited.

ACCOUNTING PACK II —
Accounting Pack II is a much more powerful version of Accounting Pack I. It has all the features of Accounting Pack I, plus up to 250 entries per period, MENU, Optional debit-credit of entries, easy addition or deletion of accounts, formatter for reports, intelligent report generator and single entry for sales transactions. Accounting Pack II requires at least 8K additional memory for your PET. OPTIONS: 1. Accounting Pack I to Accounting Pack II data file converter (free to previous owners of Accounting Pack I).
.... **$45.00**

BUSINESS ANALYSIS —
Business Analysis allows management to have available to them information for financial planning decisions. Up to 4 years of balance sheet and income statement information can be entered with resultant analysis in the areas of liquidity, leverage, profitability and activity. The ratios generated for each year are the: current ratio, acid test, debt-nw, profit-nw, profit margin, sales-rec, sales-inv, sales-wc, with a brief explaination of each. The growth analysis gives the yearly growth in 5 areas and the average growth in 5 areas. Future growth analysis projects figures for the next year.
.... **$30.00**

FINANCIAL PACK I —
Financial Pack I includes Amortization Schedule, Calendar (which figures days between two dates), Rebate (which is calculated on the Rule of 78's), Compound, Annuities and Monthly payment.
.... **$15.00**

CHESSBOARD —
Chessboard allows two players to play chess on your own PET graphic chessboard. This program displays each player's time and records each move to allow you to playback the game at another time.
.... **$15.00**

PAYROLL—
Especially designed with the small businessman in mind. Utilizing cassettes can record data for any number of employees (8 employees per cassette). Computes tax information and updates totals for quarterly and yearly reports. Employees can be salaried or hourly and pay periods can be either weekly, bi-weekly, semi-monthly or monthly.
.... **$30.00**

BUSINESS GRAPHIC PACK 1 —
Business Graphic Pack 1 is a simple program to use, but professional in output. The graph includes title, labeling of axis, dual graphic ability, whether the data is in Mill's, 100's or 1000's, and an optional x-axis = date and labeling of the x-axis with month and year. Entry is as easy as typing the title, # of entries, the X,Y value (Jan. 15, 1978 would be entered as 115.78), entering if the x-axis = date, if the user wants crosshatching and then graphing. The program also includes Nth order and Geometric regression to give the user a formula for his set of data (if possible).
.... **$25.00**

CHECKBOOK RECONCILIATION —
Designed for ease of use and to find those troublesome checkbook errors, this program balances your checkbook and bank statement from month to month. It locates over ten different types of errors and instructs the user on correcting them, including bank statement errors made by your bank. Records data on cassette for next month's balancing - saving re-entry of figures.
.... **$25.00**

CALCULATOR —
Especially for the accountant-bookkeeper. This program not only allows your PET to function as a calculator, but also has such features as Lister (which verifies and displays errors between two tape listings) and Matrix (which adds columns vertically and horizontally).
.... **$10.00**

All Programs include documentation, are in BASIC and on cassette.

*PET is a trademark of Commodore Business Machines, Inc.

Sawyer Software

201 Worley Road
Dexter, Mo. 63841
314-624-7611

master charge

VISA

WATCHING A CASSETTE LOAD

Jim Butterfield

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

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

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

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

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

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

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

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

CONTROLLED RESTORE

Earl Wuchter

This routine will reset the DATA pointer to the beginning of any DATA line. It is useful when some data statements are to be read more than once from different places in a BASIC program. To use the routine, set RS= the desired DATA line number, and GOSUB 6000. A word of caution: since the line number is a BASIC constant, it will not be automatically changed if the program is resequenced. The sample program shows how the subroutine can be used.

```
10 REM SAMPLE PGM USING CONTROLLED RESTORE
20 READ A,B,C,D,E :PRINT A;B;C;D;E
30 DATA 1,2,3,4,5
40 DATA 41,42,43,44,45
50 READ F,G,H,I,J :PRINT F;G;H;I;J
60 RS=40 :GOSUB 6000
70 READ F,G,H,I,J :PRINT F;G;H;I;J
80 END
6000 IF PEEK(142)+16*PEEK(143)>=RS THEN RESTORE
6010 FOR J=0 TO 5 :SV%(J)=PEEK(J+142) :NEXT
6020 READ J$
6030 IF PEEK(142)+16*PEEK(143)<RS GOTO 6010
6040 FOR J=0 TO 5 :POKE 142+J,SV%(J) :NEXT
6050 RETURN

Output: 1 2 3 4 5
        41 42 43 44 45
        41 42 43 44 45
```

PET 2001-8 Computer--Standard PET with integral cassette and calculator type keyboard. 8K bytes of memory. (7167 net). $ 795.00

PET 2001-16N Computer--PET with 16K bytes of memory and large keyboard with separate numeric pad & graphics on keys. External cassette optional. (15,359 net) $ 995.00

PET 2001-16B Computer--As above but has standard typewriter keyboard. No graphic keys. $ 995.00

PET 2001-32N Computer--Identical to 2001-16N with 32K bytes of memory. (31,743 net). $1,195.00

PET 2001-32B Computer--Identical to 2001-16B with 32K bytes of memory. (31,743 net). $1,195.00

PERIPHERALS

PET 2021 Printer--80 column dot matrix electro-static printer with full PET graphics capability. $ 549.00

PET 2022 Printer--80 column dot matrix printer with plain paper or forms handling tractor feed. Has full PET graphics. $ 995.00

PET 2023 Printer--80 column dot matrix printer. Plain paper printer with full PET graphics. $ 849.00

PET 2040 Dual Drive Mini Floppy Disk--Dual drive intelligent mini floppy system. 343K net user storage capacity. $1,095.00

PET 2041 Single Drive Floppy Disk--Single drive intelligent mini floppy. 171.5K user storage. $ 595.00

PET External Cassette-Cassette player/recorder to use with PET 2001/8/16/32. $ 95.00

PET User Manual--160 page expanded user manual. $ 9.95

MICROTRONICS_M-65 Ham Interface--Wired $ 99.95

--Kit $ 69.95

SOFT-WARE

V-1--CANNON BALL--Requires 2 players. Each calculates the angle and velocity of a cannon ball dependent upon wind and terrain conditions (which change each game).

3D TIC TAC TOE--Requires 1 player vs. the PET. The board consists of 4 layers of 4 x 4 boards. BOTH $ 5.95

V-2--WEATHER WAR--Requires 2 players taking alternate turns directing various types of storms against their neighbor's house. Correct calculation of storm's angle (and type) destroys a house in part.

BINGO--For 1 to 4 players. Four different Bingo cards are put on the screen and the PET calls out the numbers. BOTH $ 5.95

V-3--MISSLE RANGE--Requires 2 players, each player taking alternate turns firing a missle at a group of targets. Angle of missle is under players control.

AWARI--Requires only 1 player playing against the PET. Awari is an ancient African game in which the player and the PET move a group of stones around a board consisting of 6 bins on each side. BOTH $ 5.95

V-4--SPIN TO WIN--Requires 1 to 9 players and the PET (if you want it to). Each player takes a turn at stopping the spinning roulette-type wheel.

BATTLESHIPS--A famous naval game requiring 1 or 2 players. Each player places his/her naval fleet on the board while other player looks away. BOTH $ 5.95

V-5--DOG RACE--Requires 1 to 9 players. A game consists of players placing bets on 5 different dogs that race two laps around the track.

MASTERMIND--Requires 1 player. PET selects a number and you try to guess correct digits and their positions. BOTH $ 5.95

V-6--HOMEWORK--Lets your child practice against the PET. Addition, subtraction, multiplication, and division--all ran on one program. For students who need practice on higher numbers. $ 5.95

ALL STOCK ITEMS ARE PREPAID IN LOWER 48. ALL ITEMS U.S. FUNDS.

VARITRON
Box 729
Chinook, MT 59523

ANNOUNCEMENTS

So that everyone knows my biases, I work full time at A B Computers in Montgomery, PA. A B Computers sells PET computers among other things. Since the PET User Notes were not commercially oriented, I have made every effort to keep my two activities separate. I hope I haven't disappointed anyone, and that I have been moderately objective during the past year. My apologies for not having been as responsive or as timely as I should have been with the User Notes. Thanks to everyone for the support extended. I'm sure the Notes will be more effective with Roy involved. —G.B.

Don Henderson, Box 604, Westminster, CA 92683 announced an adaptor to allow a 2114 to be used in place of a 6550 RAM. The adaptor works for video RAM locations only (switch your video chips to bad 8K locations and use the adaptor) unless you build a decoder (Don has a PC board for this also). Price assembled is $6.20 including postage.

ASM/TED, Macro Assembler and Test Editor for PET, Apple II, or SYM was announced by C.W. Moser, 3239 Linda Drive, Winston-Salem, NC 27106. The machine language package occupies 8K of memory starting at 2000 hex.

Dave Gomberg, 7 Gateview Court, San Francisco, CA 94116 is offering a PILOT package containing language processor, editor, simple program, teachers manual, and reference card for $12. Also available for $8 is a PILOT tutorial.

Chris Crawford, Pleiades Game Co., 202 Faro Avenue, Davis, CA 95616 has developed TANKTICS, a sophisticated simulation of World War II armored combat (you command a force against the PET). The package comes with instruction manuals, machine language and BASIC program cassette, battlefield map and playing counter, and costs $15.

LAS VEGAS PET USERS are looking for members. Information can be had by contacting: Home Computers, 1775 E. Tropicana, Las Vegas,NV (702) 736-6363.

To all PET owners in and around Salt Lake City, UT interested in forming a PET Users Group contact Dee Husted, 4634 Eskesen Dr., Granger, UT 84120 966-0879.

Richard T. Tabbert, Glendale, AZ, would like contact with other PET users in Phoenix area. Contact him at 5014 W. Puget Ave., Glendale, AZ (602) 931-4544.

Northern Virginia PET User Group now called CAPE (Capital Area PET Enthusiasts); meeting 2nd Saturday each month at Patrick Henry Library, 101 Maple, Vienna VA.Contact Bob Karpen, 2054 Eakins Ct., Reston, Virginia 22091 860-9116.

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ROM SUBROUTINES

Mark Zimmermann

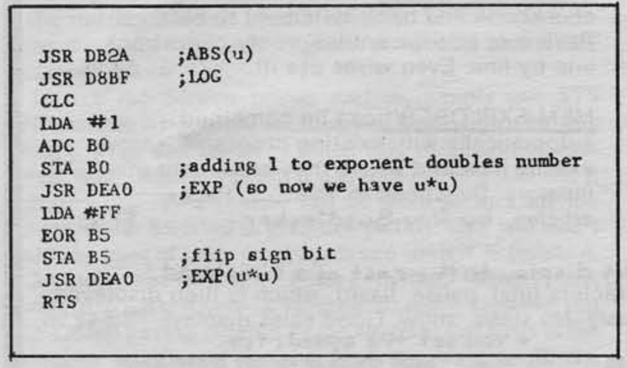
In order to hinder their competitors' efforts to rip off their excellent BASIC interpreter, MICROSOFT (and Commodore) have not released any significant information about the BASIC used in the PET microcomputer. If one wants to write machine-language programs which do floating-point mathematics, one apparently has to write all of ones own routines. This is not only hard to do; it also wastes space in RAM, and is particularly frustrating when one just wants to call a simple function available in BASIC.

In this note, I'd like to share some addresses I've discovered in the PET ROMs which are useful for executing single-argument functions: SQR, RND, LOG, EXP, etc. I'd also like to make an appeal for information from readers who have figured out how to do two-argument (dyadic) functions such as +, *, /, and ↑.

As most PET machine-language users know by now, MICROSOFT BASIC stores floating-point numbers using 32 bits for the fractional part and an 8-bit exponent, with a trick to include the sign bit in the fractional part. (See PEOPLE'S COMPUTERS, Vol. 7, No. 2 (Sept.-Oct. 1978) pages 16-19 for a more detailed description.) When doing calculations, numbers are moved to the page zero "floating accumulator" in memories B0-B5, and the sign bit is unfolded from the fractional part. B0 holds the exponent of the floating-point number with 80 added to it (128 decimal added); the binary fraction, normalized to be between 1/2 and 1, is stored in B1, B2, B3, and B4, with radix point at the left; and bit 7 of B5 is the sign bit of the floating-point number.

If a user-developed machine-language program uses the same format, puts a number into B0-B5, and then calls a PET ROM subroutine, when control returns from the subroutine the result of the function called will be returned in the floating accumulator. That's all one needs to know to use the table of ROM subroutines which follows!

For example, to calculate exp(-u^{2}) via ROM subroutines (for nonzero u) the following sample assembly-language program will do the trick:



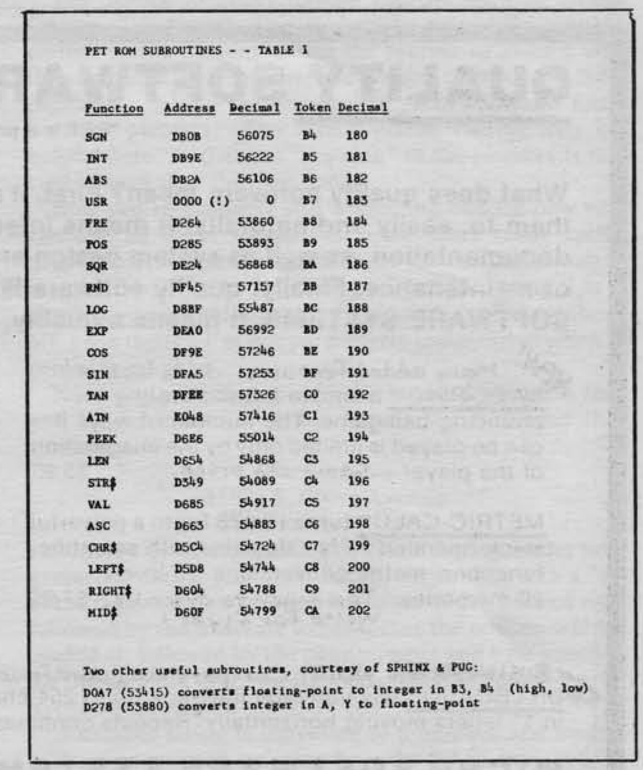
```
JSR DB2A     ;ABS(u)
JSR D8BF     ;LOG
CLC
LDA #1
ADC B0
STA B0       ;adding 1 to exponent doubles number
JSR DEA0     ;EXP (so now we have u*u)
LDA #FF
EOR B5
STA B5       ;flip sign bit
JSR DEA0     ;EXP(u*u)
RTS
```

(if any of the reduced listings can't be read, send a couple of stamps to Box 379 for full-size copies.)

If this program is called using the USR(U) function, the PET's BASIC will set up U in the floating accumulator for you, and will re-translate and store (or print, or whatever you want) the result for you after control leaves the USR function. Unfortunately, it turns out to take about twice as long to calculate exp(-u^{2}) this way as it does to just define a BASIC function: DEF FNG(X)= EXP(-X*X). The problem, of course, is that to square u, we used the LOG and EXP functions instead of simply multiplying u*u! So, if anyone can tell me where to find and how to use the simple floating-point operations like addition and multiplication, I'll be most grateful!!

I found the addresses given in Table 1 while prowling through the PET's ROMs. In particular, the code following address CCB8 which evaluates BASIC expressions led me to a table following address BFDE. As many of you probably know, PET BASIC stores key words (such as EXP, COS, ASC, etc.) as single-byte "tokens". (Table 1 includes the hexadecimal values of the tokens in column 4.) PET's BASIC doubles the value of the token (throwing away any carry) and puts that into its Y register. It then looks up the address stored in BFDF+Y and BFDE+Y. That's the address of the function subroutine to be executed!

I'd like to acknowledge the help of Jim Butterfield, who compiled token lists and gave me a wonderful disassembler.



PET ROM SUBROUTINES - - TABLE 1

Function	Address	Decimal	Token	Decimal
SGN	DB0B	56075	B4	180
INT	DB9E	56222	B5	181
ABS	DB2A	56106	B6	182
USR	0000 (!)	0	B7	183
FRE	D264	53860	B8	184
POS	D285	53893	B9	185
SQR	DE24	56868	BA	186
RND	DF45	57157	BB	187
LOG	D8BF	55487	BC	188
EXP	DEA0	56992	BD	189
COS	DF9E	57246	BE	190
SIN	DFA5	57253	BF	191
TAN	DFEE	57326	C0	192
ATN	E048	57416	C1	193
PEEK	D6E6	55014	C2	194
LEN	D654	54868	C3	195
STR$	D349	54089	C4	196
VAL	D685	54917	C5	197
ASC	D663	54883	C6	198
CHR$	D5C4	54724	C7	199
LEFT$	D5D8	54744	C8	200
RIGHT$	D604	54788	C9	201
MID$	D60F	54799	CA	202

Two other useful subroutines, courtesy of SPHINX & PUG:

D0A7 (53415) converts floating-point to integer in B3, B4 (high, low)
D278 (53880) converts integer in A, Y to floating-point

continued.......

```
PET ROM SUBROUTINES - 1979.2.18 - Mark Zimmermann, Caltech 130-33, Pasadena, CA  91125
----------------------------------------------------------------------------------------
                         example
S  P      contents     S=e P=-π/2         all numbers in hex below this line
B8 B0 exponent+80       82   81
B9 B1 fraction MSB      AD   C9
BA B2 frac. byte 2      F8   0F
BB B3 frac. byte 3      54   DA
BC B4 fraction LSB      59   A2
BD B5 sign              00   FF
BE    sign comparison FF
BF    roundoff byte     00
                                          Note: +,-,*,/, and ↑ must be called with S in
0000 USR(P)                                     B8-BD, sign comparison set to (B5) EOR (BD),
CED6 S OR P                                     and (B0) in A
CED9 S AND P
D264 FRE(P)
D285 POS(P)
D349 STR$
D5C4 CHR$                                 Constants in floating (merged sign) notation:
D5D8 LEFT$
D604 RIGHT$                                     E024  1/4
D60F MID$                                       DDE3  1/2
D654 LEN                                        E01A  π/2
D663 ASC                                        CDBC   π
D685 VAL                                        E01F  2π
D6E6 PEEK
D728 S - P
D73C JSR D95E, then S + P
D73F S + P
D7AC normalize P
D8BF LOG(P)
D8FD JSR D95E, then S * P
D900 S * P
D95E [A+100Y]→S, separating sign, set sign comparison, return with (B0) in A
D9E4 S / P
DA74 [A+100Y]→P, separating sign
DAA6 roundoff(P)→[X+100Y], merging sign
DACE S→P
DADE P→S, with rounding
DAE1 P→S, without rounding
DAED roundoff(P)
DAFD SGN(P)→A
DB0B SGN(P)
DB2A ABS(P)
DB9E INT(P)
DE24 SQR(P)
DE2E S ↑ P
DEA0 EXP(P)
DF45 RND(P)
DF9E COS(P)
DFA5 SIN(P)
DFEE TAN(P)
E048 ATN(P)

Thanks to Jim Butterfield, Gene Beals' PET USER GROUP, and SPHINX for helpful data.

conversions:  D0A7 P→integer in B3,B4 [100B3+B4]
              D278 integer in A,Y [100A+Y] → P
```

MACHINE LANGUAGE ROUTINES FOR FAST GRAPHICS

Warren Swan

Now you BASIC programmers, don't go flipping past this article. The machine language routines in this article do not have to be understood to be used. They merely let you do some things with your PET's display screen that you cannot do as fast in BASIC.

There are five machine language routines presented in this article. They consist of routines to

- toggle the screen on/off bit to turn the screen off or on
- fill the screen with any requested character
- inverse every character on the screen so that unreversed characters are reversed and reversed characters are unreversed
- scroll the screen down one 40 character line, instead of up
- swap the screen memory with 1K of RAM that is rendered inaccessible to BASIC, including the current graphics mode swapped with the stored graphics mode in the swap area.

A BASIC loader program, which can be used to load *any* machine language routine *anywhere* in unused RAM, is also presented and used to load the package of graphics machine language routines.

Listings 1 through 5 are the assembly language programs for the five routines. All routines but the Screen Filler routine are called from BASIC via the SYS command. The Screen Filler (listing 1) is called via the USR command.

To use these routines, type in the relocating loader program in listing 6 and RUN it. It will ask you where the base location at which you wish to load these routines is. Most likely, you will want to load them in a protected area of memory such as the buffer area for the second cassette recorder if you don't use one. If you wish to use the second cassette buffer, enter 826 for the base. If you want to load them at the top of memory and keep them from being mutilated by BASIC, execute the following statements:

```
POKE135,PEEK(135)−1:CLR
PRINT PEEK(135)*256+PEEK(134)
```

Then RUN the program and enter the number printed by the second line above for the base.

At any rate, the loader program will load these routines into memory and print the absolute location that is the starting address of each routine. Write these locations down for later use. Ignore the PAGE and BYTE columns for now.

To use the Screen off/on routine, simply use SYS NNN; where NNN is the location you wrote down for this routine from the loader. When this command is executed, if the screen was on, it will turn off; if it was off, it will turn on. This routine can be used to turn off the screen while forming a graphics picture that you don't want the user of your program to see until it is finished.

To use the Screen Filler routine, simply use A=USR(NNN); where A is some dummy variable you don't mind having cleared by the routine, and NNN is the character number of the character you want to fill the screen. The routine will instantly fill the PET's screen with the desired character. If you are not familiar with the "character number" to which I refer, these are the numbers (0 to 255) which you can POKE into the PET's screen RAM to display them. To find out what all 256 character numbers are for, execute the following command line:

```
FOR L=0 TO 255:POKE L+32768,L:NEXT
```

This routine can be used to fill the screen with a given character as a background to a graphic display. Or it can be used to create dazzling displays that cause the screen to appear to be moving.

To use the Screen Inverse routine, simply use SYS NNN; where NNN is the location you wrote down for this routine from the loader. When this command is executed, the screen will be "inversed". That is, every unreversed character will be reversed; and every reversed character will be unreversed. This routine may be used to cause a graphics picture to flash or blink.

To use the Screen Scroll-down routine, simply use SYS NNN; where NNN is the location you wrote down for this routine from the loader. When this command is executed, the lines of the screen will scroll down, just as they would scroll up when printing off the last line of the screen. This routine can be used to move entire pictures on the screen down, and with help from the PRINT statement, up.

To use the Screen Swapper routine, simply use SYS NNN; where NNN is the location you wrote down for this routine from the loader. The first call to this routine is only used to set up pointers and clear the "save area" - the memory locations that will contain the contents of the screen that are swapped into it. After the initial call the user must execute a NEW or CLR command. Otherwise, BASIC will continue to store strings in the save area.

The Screen Swapper routine may be used to create "moving" pictures. This is done by printing a graphic picture on the screen, calling the routine to swap it into the store area, printing another graphic picture, and then repeatedly calling the Swapper to swap back and forth between pictures. The Screen off/on routine may be helpful here, so that the "drawing" of the pictures is not visible until after they are done.

Now you're probably still wondering exactly how you can use all these routines to draw some really spiffy graphic pictures and animate them (unless you're super imaginative). So to help get you started, listing 7 is a demo program that uses all of the routines to show them off, even though I'm not particularly imaginative when it comes to graphics.

Need any more fast graphic routines? Drop me a line and let me know. I should have some free time this summer...

Warren Swan
15933 S. Grove Avenue
Oak Forest, IL 60452

also, just a quick explanation of the relocating loader program. All data is read in as string. Any string with a "/" at the right is taken as a routine name and is printed out, followed by the absolute location that the routine will be loaded at; followed by the page number and byte number for this location (e.g., location 826 (decimal) is at page 3, byte 58 because 826=3*256+58).

A number string is converted to a number and loaded at the next location (starting from the BASE initially). If a number has a "*" attached to the right, it is added to the most recent routine starting address and the two byte address so formed is loaded into the next two locations, CONNECTICUT microCOMPUTER, Inc.

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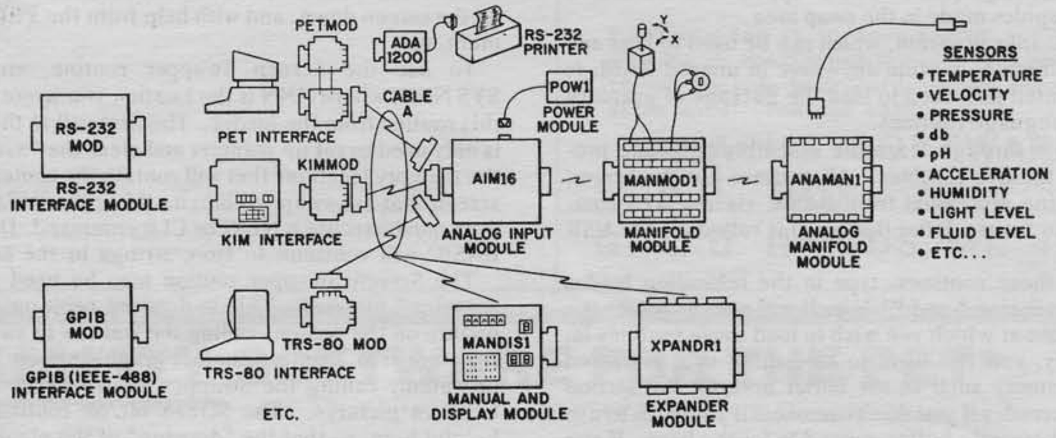

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low byte followed by high byte. This is used to load absolute adresses given as offsets within the current routine.

If a number has a "!" attached to the right, it is added to the BASE address and the two byte address so formed is loaded into the next two locations. This is used to load absolute addresses given as offsets to the BASE location.

The signal for the end of data is the "#" character followed by a number which is added to the BASE address and the two byte address is stored in locations 1 and 2 for the USR function.

LISTING 1: Screen off/on routine.

```
            *=BASE
AD11E8      SWITCH  LDA  $E811   ! Load 'PIAL1'.
4908                EOR  #08     ! Flip bit 3 (screen control).
8D11E8              STA  $E811   ! Store 'PIAL1'.
60                  RTS
```

LISTING 2: Screen Filler routine.

```
            *=BASE+9
20A7D0      FLLSCN  JSR  $D0A7   ! Get integer parameter.
A000                LDY  #00     ! Initialize offset.
8420                STY  $20     ! Screen pointer low byte.
A280                LDX  #$80    ! Screen address high.
A5B4                LDA  $B4     ! Get parameter (Character #).
8621        NXTPAG  STX  $21     ! Screen pointer high byte.
9120        NEXT    STA  ($20),Y ! Store character in screen.
C8                  INY          ! Next location.
D0FB                BNE  NEXT    ! End of page? NO: Repeat.
E8                  INX          ! YES: Next page.
E084                CPX  #$84    ! Finished last page?
D0F4                BNE  NXTPAG  ! NO: Do next page.
                                 ! Now comes several options:
60          WAIT    RTS          ! Return immediately.
                 or
AD0302      WAIT    LDA  $0203   ! Test 'key pressed' location.
49FF                EOR  #$FF    ! If no key pressed:
F0F9                BEQ  WAIT    ! THEN wait for key to be pressed.
60                  RTS          ! ELSE return.
                 or change BEQ  WAIT to BNE  WAIT:
D0F9                BNE  WAIT    ! THEN return, ELSE wait for key to
                                 ! be released.
```

LISTING 3: Screen Inverse routine.

```
            *=BASE+40
A280        INVRS   LDX  #$80    ! Screen address high.
A000                LDY  #00     ! Initialize offset.
8421                STY  $21     ! Screen pointer low byte.
8622        NXTPAG  STX  $22     ! Screen pointer high byte.
B121        NEXT    LDA  ($21),Y ! Get character from screen.
4980                EOR  #$80    ! Flip bit 7 (rvs/un-rvs bit).
9121                STA  ($21),Y ! Store character back to screen.
C8                  INY          ! Next location.
D0F7                BNE  NEXT    ! End of page? NO: Repeat.
E8                  INX          ! YES: Next page.
E084                CPX  #$84    ! Finished last page?
D0F0                BNE  NXTPAG  ! NO: Do next page.
60                  RTS          ! YES: Return.
```

LISTING 4: Screen Scroll-down routine.

```
            *=BASE+63
20          SCRDWN  JSR  SWITCH  ! Turn off screen. Note SWITCH=BASE.
A028--              LDY  #$28    ! Initialize offset. Destination is
8422                STY  $22     ! 40 bytes beyond source.
A000                LDY  #00     ! Set up source pointer
8420                STY  $20     ! low byte.
A0BF                LDY  #$BF    ! Start @ last char. of 2nd to last
A283                LDX  #$83    ! line. Address high.
8621        NXTPAG  STX  $21     ! Store pointers'
8623                STX  $23     ! high bytes.
B120        NEXT    LDA  ($20),Y ! Get source byte.
9122                STA  ($22),Y ! Put in destination location.
88                  DEY          ! Next byte.  End of page?
C0FF                CPY  #$FF    ! (I.e.- have we gone past zero?)
D0F7                BNE  NEXT    ! NO: Next byte.
CA                  DEX          ! YES: Next page.
E07F                CPX  #$7F    ! Last page done?
D0EE                BNE  NXTPAG  ! NO: Do next page.
A027                LDY  #39     ! YES: Reset offset to 39 (decimal).
A920                LDA  #$20    ! Load accumulator with ASCII space.
9120        CLR     STA  ($20),Y ! Clear top line of screen.
88                  DEY          ! Next byte. All 40 bytes done?
10FB                BPL  CLR     ! NO: Clear next location.
4C____              JMP  SWITCH  ! Turn on screen and return.

Pointer to source location:      Pointer to destination location:
     $20  $21                                  $22  $23
    | 00 | 83 |          (Initially)          | 28 | 83 |
```

(if any of the reduced listings can't be read, send a couple of stamps to Box 379 for full-size copies.)

LISTING 5: Screen Swap routine.

```
            *=BASE+108
A200        SWAP    LDX  #00     !
A993                LDA  #147    ! Load flag value.
F003                BEQ  SKIP    ! If not first time through,
                                 ! skip initialization.
A587                LDA  $87     ! Load high byte of pointer to top
38                  SEC          ! of memory. Subtract off 4 pages
E904                SBC  #04     ! (1K bytes) of memory and
8587                STA  $87     ! restore pointer. BASIC now has
                                 ! access to 1K less memory.
A90C                LDA  #12     ! Set initial default
8186                STA  ($86,X) ! mode to graphics.
20____      SKIP    JSR  SWITCH  ! Turn off screen.
A186                LDA  ($86,X) ! Swap current
AC4CE8              LDY  $E84C   !  graphics mode
8D4CE8              STA  $E84C   !   byte with previously
98                  TYA          !    stored graphics
8186                STA  ($86,X) !     mode byte.
A486                LDY  $86     ! Save area pointer low byte
C8                  INY          ! (should always be 1, unless bad
8420                STY  $20     ! memory chips).
8622                STX  $22     ! Screen area pointer low byte (zero).
A000                LDY  #00     ! Initialize offset.
A687                LDX  $87     ! Save area high byte (also pointer
8621                STX  $21     ! to top of memory).
A280                LDX  #$80    ! Screen area pointer high byte ($80).
8623        NXTPAG  STX  $23     ! Set up for next page to screen.
B120        NEXT    LDA  ($20),Y ! Get stored byte.
48                  PHA          ! Save temporarily.
B122                LDA  ($22),Y ! Get screen byte and
9120                STA  ($20),Y ! store it in save area.
68                  PLA          ! Recall stored byte
9122                STA  ($22),Y ! and store it in screen.
C8                  INY          ! Next byte. End of page?
D0F3                BNE  NEXT    ! NO: Do next byte.
E621                INC  $21     ! YES: Increment pointers to
E8                  INX          ! next page. Finished last page?
E084                CPX  #$84    ! (last page of screen is @ $8300):
D0EA                BNE  NXTPAG  ! NO: Do next page.
AD____              LDA  SWAP+3  ! YES: Get flag again. Print it.
20D2FF              JSR  $FFD2   ! (First time it is 'clear screen').
8C____              STY  SWAP+3  ! Zero flag for subsequent calls.
4C____              JMP  SWITCH  ! Turn on screen and return.
```

The first time the user calls SWAP (via the SYS command) it initializes the Top-of-Memory pointer for BASIC and clears out the save area. It then swaps the current screen contents with the save area and sets the graphics mode to graphics (not lower case). After the first call to SWAP, the user must execute a NEW or CLR command so that BASIC will not put string data into the save area.

NOTE***: This code may not be used in Read Only Memories. It is "impure code" which modifies itself.

LISTING 6: Relocating Loader for Machine Language Routines in BASIC.

```
0 REM PACKAGE LOADER VERSION 1.1 - GRAPHICS 1.4 PAC BY WARREN D. SWAN
 1978-1979
10 INPUT"csBASE:";BASE
20 DATASWITCH/,173,17,232,73,8,141,17,232,96
30 DATASCREEN FILLER/,32,167,208,160,0,132,32,162,128,165,180,134
 ,33,145,32
40 DATA200,208,251,232,224,132,208,244,96,3,2,73,255,240,249,96
50 DATASCREEN INVERTER/,162,128,160,0,132,33,134,34,177,33,73,128
 ,145,33,200
60 DATA208,247,232,224,132,208,240,96
70 DATASCROLL DOWN/,32,0!,160,40,132,34,160,0,132,32,160,191,162,131
 ,134,33,134
80 DATA35,177,32,145,34,136,192,255,208,247,202,224,127,208,238,160
 ,39,169,32
90 DATA145,32,136,16,251,76,0!
100 DATASCREEN SWAP/,162,0,169,147,240,11,165,135,56,233,4,133,135
 ,169,12,129
110 DATA134,32,0!,161,134,172,76,232,141,76,232,152,129,134,164,134
 ,200,132
120 DATA32,134,34,160,0,166,135,134,33,162,128,134,35,177,32,72,177
 ,34,145
130 DATA32,104,145,34,200,208,243,230,33,232,224,132,208,234,173,3*
 ,32,210
140 DATA255,140,3*,76,0!
990 DATANEXT AVAILABLE LOCATION/,#,9
1000 B=BA:I=0:PRINT"cs cdBASE:BA TAB(30)"PAGE BYTEcd
1010 READN$:IFN$="#"THENREADN:N=BA+N:GOSUB2000:POKE1,L:POKE2,H
 :GOTO1080
1020 N=VAL(N$):R$=RIGHT$(N$,1):IFR$="/"THENB=B+I:I=0:N=B:GOSUB2000
 :GOTO1060
1030 IFR$="*"THENN=N+B:GOSUB2000:POKEB+I,L:POKEB+I+1,H:I=I+2:GOTO1010
1040 IFR$="!"THENN=N+BA:GOSUB2000:POKEB+I,L:POKEB+I+1,H:I=I+2:GOTO1010
1050 POKEB+I,N:I=I+1:GOTO1010
1060 N=LEN(N$)-1:IFN 23THENN=23
1070 PRINTLEFT$(N$,N)":"B"cl"TAB(30)H"cl"TAB(34)L:PRINT:GOTO1010
1080 PRINT"USR:"N,B-BA"BYTES TOTAL":END
2000 H=INT(N/256):L=N-H*256:RETURN
```

cs is clear screen, cd is cursor down, cl is cursor left

(listing 7 on p. 19)

SINGLE—STEP TRACE ROUTINE

Jim Russo

MT6671 is a machine-language monitor program incorporating a single-step trace feature. It occupies locations 1A00-1FFF, and is started by SYS 6671. It includes all the commands of the Commodore Monitor, plus a Disassemble command and a Trace command. The R command is used first to set-up the registers and program counter. The T command executes just one instruction of the user program, then displays the new contents of the registers (SR,AC,XR,YR,SP,PC) followed by the instruction at the PC and its disassembly. At this point the user may depress the RVS key to continue at about 2 instructions per second, the SPACE key to continue as fast as the PET can print the registers, the less-than key to step through one instruction at a time, or the STOP key to return to the monitor. A sample trace is included as Figure 1.

Notice that the instructions are displayed before they are executed. If you wish to change the flow of a program, you can STOP, use the R command to modify registers, or the M command to change memory, and then the T command to resume tracing.

There are some limitations on the use of the trace. Page zero locations 0A-22 and 40-47 are used, so beware of conflicts with the program you're tracing. Interrupts are used to step the program. If the user program changes the interrupt vector (219-21A) or the interrupt enables, the PET may crash.

The major portion of MT6671 is the Commodore Monitor, relocated to 1A0F-1D6A. It also includes the 6502 disassembler program, which has been around longer than the PET, at locations 1E00-1FE3. The part which I contributed is the trace feature, which includes little bits of code tucked in wherever there was room.

The execution of a single instruction is accomplished by setting the interval timer in the VIA to interrupt during the instruction. When the interrupt occurs, the PET saves the register contents, and jumps through the interrupt vector (219-21A) back to MT6671.

To illustrate how this is done, I have patched a simple single-step routine onto the Commodore Monitor. A complete listing of the Monitor is in the PET MANUAL. The patch is shown in Figure 2.

The routine which recognizes commands is modified to include T (498 and 76B-76E). When the T command is recognized, the interrupt vector is changed (776-77D) to point to 795. The interval-timer interrupt is enabled and the 60Hz interrupt disabled (780-785). The timer is set (78A-78F) for the period of time necessary to execute the remaining instructions in the monitor up to the RTI which effects the jump to the user program. The the GO routine in the monitor is used to load the registers and jump to the user program. When the interrupt occurs, control returns to the subroutine call at 795. A ROM subroutine is used to restore the interrupt vector and interrupt enables for the normal 60Hz interrupt service. Interrupt is turned back on (798), a bit set so the monitor won't decrement the PC (799), and control is returned to the monitor BRK routine which displays the registers.

This illustration program doesn't have all the features of MT6671, but it does illustrate how the task of controlling program execution one instruction at a time is accomplished.

MT6671 is available through the PET User Group. Future revisions will incorporate additional features. It will also be available relocated to other areas of memory, to allow its use with other programs that reside in 1A00-1FFF. Correspondence from interested users is welcome.

Jim Russo, 1421 Pine Valley, Ann Arbor, MI 48104

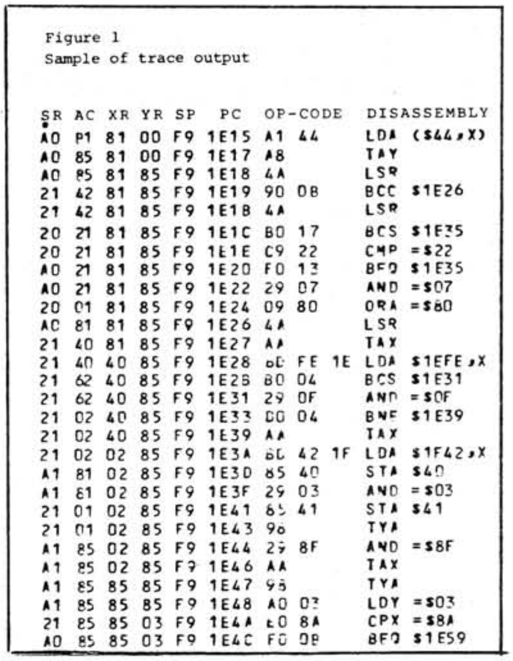

Figure 1
Sample of trace output

```
SR AC XR YR SP  PC  OP-CODE   DISASSEMBLY
A0 P1 81 00 F9 1E15 A1 44     LDA ($44,X)
A0 85 81 00 F9 1E17 A8        TAY
A0 85 81 85 F9 1E18 4A        LSR
21 42 81 85 F9 1E19 90 0B     BCC $1E26
21 42 81 85 F9 1E1B 4A        LSR
20 21 81 85 F9 1E1C B0 17     BCS $1E35
20 21 81 85 F9 1E1E C9 22     CMP =$22
A0 21 81 85 F9 1E20 F0 13     BEQ $1E35
A0 21 81 85 F9 1E22 29 07     AND =$07
20 01 81 85 F9 1E24 09 80     ORA =$80
AC 81 81 85 F9 1E26 4A        LSR
21 40 81 85 F9 1E27 AA        TAX
21 40 40 85 F9 1E28 BD FE 1E  LDA $1EFE,X
21 62 40 85 F9 1E2B B0 04     BCS $1E31
21 62 40 85 F9 1E31 29 0F     AND =$0F
21 02 40 85 F9 1E33 D0 04     BNE $1E39
21 02 40 85 F9 1E39 AA        TAX
21 02 02 85 F9 1E3A BD 42 1F  LDA $1F42,X
A1 81 02 85 F9 1E3D 85 40     STA $40
A1 81 02 85 F9 1E3F 29 03     AND =$03
21 01 02 85 F9 1E41 85 41     STA $41
21 01 02 85 F9 1E43 98        TYA
A1 85 02 85 F9 1E44 29 8F     AND =$8F
A1 85 02 85 F9 1E46 AA        TAX
A1 85 85 85 F9 1E47 98        TYA
A1 85 85 85 F9 1E48 A0 03     LDY =$03
21 85 85 03 F9 1E4A E0 8A     CPX =$8A
A0 85 85 03 F9 1E4C F0 0B     BEQ $1E59
```

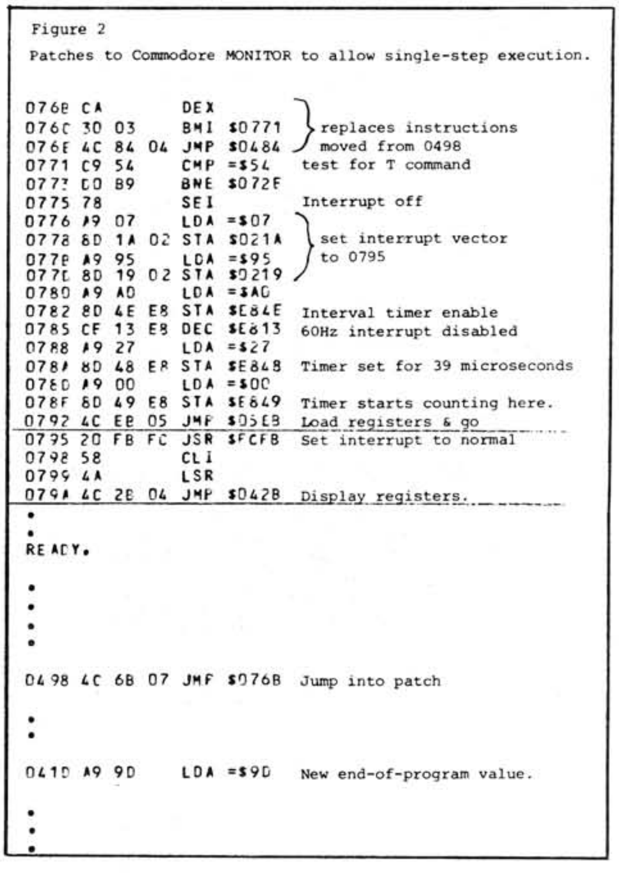

Figure 2

Patches to Commodore MONITOR to allow single-step execution.

```
076B CA       DEX        \
076C 30 03    BMI $0771   > replaces instructions
076E 4C 84 04 JMP $0484  /  moved from 0498
0771 C9 54    CMP =$54   test for T command
0773 D0 B9    BNE $072F
0775 78       SEI        Interrupt off
0776 A9 07    LDA =$07   \
0778 8D 1A 02 STA $021A   \ set interrupt vector
077B A9 95    LDA =$95    / to 0795
077D 8D 19 02 STA $0219  /
0780 A9 A0    LDA =$A0
0782 8D 4E E8 STA $E84E  Interval timer enable
0785 CE 13 E8 DEC $E813  60Hz interrupt disabled
0788 A9 27    LDA =$27
078A 8D 48 E8 STA $E848  Timer set for 39 microseconds
078D A9 00    LDA =$00
078F 8D 49 E8 STA $E849  Timer starts counting here.
0792 4C EB 05 JMP $05EB  Load registers & go
0795 20 FB FC JSR $FCFB  Set interrupt to normal
0798 58       CLI
0799 4A       LSR
079A 4C 2B 04 JMP $042B  Display registers.
•
•
READY.

•
•
•
•

0498 4C 6B 07 JMP $076B  Jump into patch

•
•

041D A9 9D    LDA =$9D   New end-of-program value.

•
•
•
```

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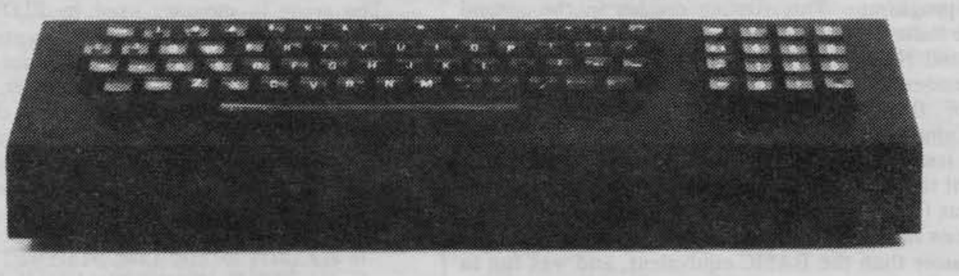

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PLOT

Jerry A. Velders

Here is a program which I call PLOT, which allows high resolution (50 x 80) plotting, driven by machine language subroutine, to be easily incorporated into BASIC programs. This routine resides in the second cassette buffer, where it is safe from commands such as LOAD and NEW, and it plots somewhat more quickly than an equivalent BASIC routine. The idea and basic logic of the program came from an article by F. J. Campbell which appeared in the User Notes in Vol. I, Issue 3. Although PLOT is pretty fast, it is apparent that most of the time used in iterative plotting programs (like a sine wave) is spent doing mathematical operations in BASIC. In any case, PLOT is about three times faster than the BASIC equivalent, and was fun to write. Maybe someone out there can benefit from it.

I've included an assembly object listing, tediously typed by hand because I don't have a printer yet, and a BASIC routine which pokes the code into memory. The program works because Commodore provided us with a set of 16 graphics characters which allow division of each pixel into four quadrants, each of which may be manipulated independently of the others. By assigning one bit of a four bit binary number to each quadrant, and using 1 and 0 to represent on and off, the logical OR function can be used to make decisions about which character to put into each pixel.

The basic task is therefore to accept values for X (horizontal displacement) and Y (vertical displacement), determine which pixel they refer to, determine which quadrant of the pixel they refer to, and OR this value with the value of the current contents to find the location of the next value in the table.

For ease of understanding, the program can be dissected into several discreet sections, as follows:

033A-0346

initialization; loads data from TABLE into zero page (put there to optimize speed)

0347-0356

TABLE; these values are data, representing the various graphic symbols associated with high density plotting

0357-0390

picks up values of X and Y from zero page (where put by BASIC) and determines in which quadrant of pixel the new square belongs

0392-03CC

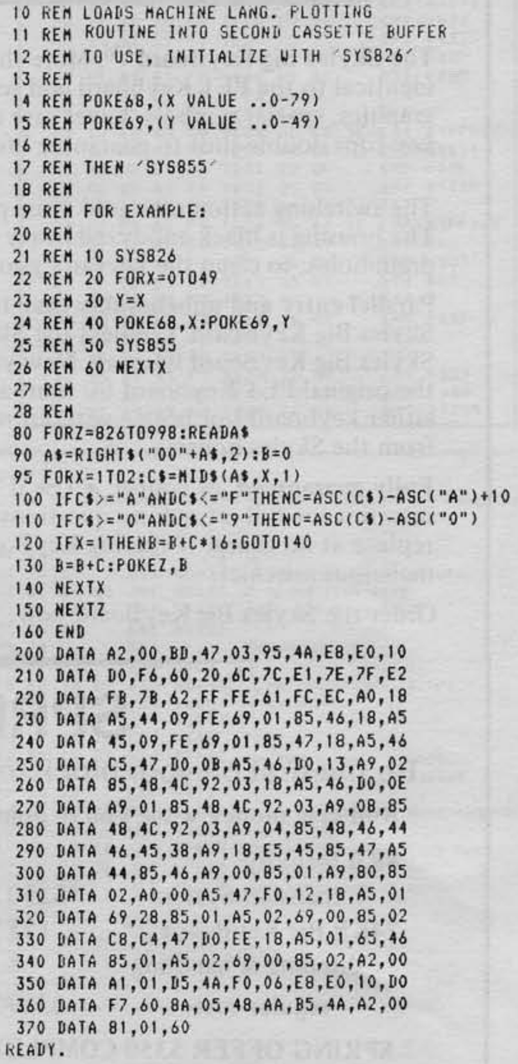
finds the screen location under consideration, as determined by X and Y, and puts the address in locations 1 (low) and 2 (high)

03CE-03E6

finds the right character from the TABLE and puts it into the right location...then returns to BASIC

The best way to understand the operation of the program is to read closely through the comments in the listing, checking out the paths it will take under various values of X and Y. Please note that there are no built-in safeguards for faulty values of X and Y. X must be from 0 to 79, and Y from 0 to 49. A mistake here probably won't make the PET crash, but can make it try to poke its way through memory, and it makes sense to be careful.

The areas in memory used by PLOT consist of the second cassette buffer (for program storage), the tail end of the input buffer in zero page (used for the table and for X and Y), and locations 1 and 2, used for the low and high address of the screen location being dealt with. You shouldn't need to re-initialize the routine (SYS826) unless there's a significant use of the input buffer, like an input of more than 50 characters or so, or an input from an external device like the cassette.



```
 10 REM LOADS MACHINE LANG. PLOTTING
 11 REM ROUTINE INTO SECOND CASSETTE BUFFER
 12 REM TO USE, INITIALIZE WITH 'SYS826'
 13 REM
 14 REM POKE68,(X VALUE ..0-79)
 15 REM POKE69,(Y VALUE ..0-49)
 16 REM
 17 REM THEN 'SYS855'
 18 REM
 19 REM FOR EXAMPLE:
 20 REM
 21 REM 10 SYS826
 22 REM 20 FORX=0TO49
 23 REM 30 Y=X
 24 REM 40 POKE68,X:POKE69,Y
 25 REM 50 SYS855
 26 REM 60 NEXTX
 27 REM
 28 REM
 80 FORZ=826TO998:READA$
 90 A$=RIGHT$("00"+A$,2):B=0
 95 FORX=1TO2:C$=MID$(A$,X,1)
 100 IFC$>="A"ANDC$<="F"THENC=ASC(C$)-ASC("A")+10
 110 IFC$>="0"ANDC$<="9"THENC=ASC(C$)-ASC("0")
 120 IFX=1THENB=B+C*16:GOTO140
 130 B=B+C:POKEZ,B
 140 NEXTX
 150 NEXTZ
 160 END
 200 DATA A2,00,BD,47,03,95,4A,E8,E0,10
 210 DATA D0,F6,60,20,6C,7C,E1,7E,7F,E2
 220 DATA FB,7B,62,FF,FE,61,FC,EC,A0,18
 230 DATA A5,44,09,FE,69,01,85,46,18,A5
 240 DATA 45,09,FE,69,01,85,47,18,A5,46
 250 DATA C5,47,D0,0B,A5,46,D0,13,A9,02
 260 DATA 85,48,4C,92,03,18,A5,46,D0,0E
 270 DATA A9,01,85,48,4C,92,03,A9,08,85
 280 DATA 48,4C,92,03,A9,04,85,48,46,44
 290 DATA 46,45,38,A9,18,E5,45,85,47,A5
 300 DATA 44,85,46,A9,00,85,01,A9,80,85
 310 DATA 02,A0,00,A5,47,F0,12,18,A5,01
 320 DATA 69,28,85,01,A5,02,69,00,85,02
 330 DATA C8,C4,47,D0,EE,18,A5,01,65,46
 340 DATA 85,01,A5,02,69,00,85,02,A2,00
 350 DATA A1,01,D5,4A,F0,06,E8,E0,10,D0
 360 DATA F7,60,8A,05,48,AA,B5,4A,A2,00
 370 DATA 81,01,60
READY.
```

There are undoubtedly ways to increase the speed of execution of this program. I'm a relative newcomer to computing and don't always know the optimum techniques to use. This is especially true in the screen address calculations in this program, in which I used successive additions of 40 to determine the screen line. I would be appreciative of any suggestions which would enhance either the speed or elegance of the program.

continued.......

By the way, I'm composing this article on the Word Processor sold by Connecticut Microcomputer, which is a very versatile tool for handling text. Although I don't have a printer, a friend has a Diablo which I used to test the RS232 interface that I bought from CMC to accompany the Word Processor. When the PET and the Diablo were connected, everything worked perfectly, and it was a little ironic to see an $800 computer driving a $3300 printer. Although we were just chugging along at 300 baud, it was really neat to have the PET write out some listings for me.

```
          PLOT

033A   A2 00        LDX #$00     ! clear X reg; used as counter
033C   BD 47 03     LDA $0347,X  ! get first byte from TABLE
033F   95 4A        STA $4A,X    ! store in zero page (input buffer)
0341   E8           INX          ! increment counter
0342   E0 10        CPX #$10     ! done yet? ( 16 values to move)
0344   D0 F6        BNE $033C    ! if not done, go get another
0346   60           RTS          ! if done, return to BASIC
0347   20 6C 7C E1               ! TABLE
034B   7E 7F E2 FB               ! TABLE
034F   7B 62 FF FE               ! TABLE
0353   61 FC EC A0               ! TABLE

0357   18           CLC          ! get ready to add
0358   A5 44        LDA $44      ! get value of X left by BASIC &
035A   09 FE        ORA #$FE     ! test bit zero to determine if
035C   69 01        ADC #$01     ! even or odd.
035E   85 46        STA $46      ! store result (0 if odd; 255 if even)
0360   18           CLC          ! get ready to add
0361   A5 45        LDA $45      ! get Y value and do the same thing
0363   09 FE        ORA #$FE     !
0365   69 01        ADC #$01     !
0367   85 47        STA $47      !
0369   18           CLC          !
036A   A5 46        LDA $46      ! get previously stored values and
036C   C5 47        CMP $47      ! compare to see if both are even or
036E   D0 0B        BNE $037B    ! both odd...if not goto 037B
0370   A5 46        LDA $46      ! if both same, are thet odd?
0372   D0 13        BNE $0387    ! if both even goto 0387
0374   A9 02        LDA #$02     ! if both odd, then it's quadrant 2
0376   85 48        STA $48      ! store quadrant number
0378   4C 92 03     JMP $0392    ! jump to next section
037B   18           CLC          ! ..just to be safe
037C   A5 46        LDA $46      ! get value
037E   D0 0E        BNE $038E    ! if X even and Y odd then branch
0380   A9 01        LDA #$01     ! otherwise, Y even & X odd.  Store
0382   85 48        STA $48      ! 1 as quadrant number
0384   4C 92 03     JMP $0392    ! jump to next section
0387   A9 08        LDA #$08     ! X and Y both even.  Store quadrant
0389   85 48        STA $48      ! number ( 8 )
038B   4C 92 03     JMP $0392    ! jump to next section
038E   A9 04        LDA #$04     ! quadrant is number 4
0390   85 48        STA $48      ! store quadrant number
0392   46 44        LSR $44      ! divide X by 2
0394   46 45        LSR $45      ! divide Y by 2
0396   38           SEC          ! get ready to subtract
0397   A9 18        LDA #$18     ! load acc with 24(dec) # of scrn lines
0399   E5 45        SBC $45      ! subtract vert. displacement (Y/2)
039B   85 47        STA $47      ! store
039D   A5 44        LDA $44      ! get horiz. displacement (X/2)
039F   85 46        STA $46      ! store
03A1   A9 00        LDA #$00     ! put zero in acc; 1st scrn addr. low
03A3   85 01        STA $01      ! store in loc. 1
03A5   A9 80        LDA #$80     ! load 1st scrn addr. high
03A7   85 02        STA $02      ! store in loc. 2
03A9   A0 00        LDY #$00     ! clear Y reg
03AB   A5 47        LDA $47      ! load acc. with line number
03AD   F0 12        BEQ $03C1    ! if zero, goto next part
03AF   18           CLC          ! ready to add
03B0   A5 01        LDA $01      ! get low address of scrn loc
03B2   69 28        ADC #$28     ! add 40 (dec)
03B4   85 01        STA $01      ! put it back
03B6   A5 02        LDA $02      ! get scrn address high
03B8   69 00        ADC #$00     ! add 0 (insures carry)
03BA   85 02        STA $02      ! put it back
03BC   C8           INY          ! increment Y reg
03BD   C4 47        CPY $47      ! are we at the right line yet?
03BF   D0 EE        BNE $03AF    ! if not go back and do it again
03C1   18           CLC          ! ready to add
03C2   A5 01        LDA $01      ! get low scrn addr
03C4   65 46        ADC $46      ! add appropriate X value
03C6   85 01        STA $01      ! put it back
03C8   A5 02        LDA $02      ! get high scrn addr
03CA   69 00        ADC #$00     ! add zero to insure carrv
03CC   85 02        STA $02      ! put it back (locs.1&2 point to scrn
03CE   A2 00        LDX #$00     ! loc where character goes)  clear X reg
03D0   A1 01        LDA ($01,X)  ! get contents of scrn location
03D2   D5 4A        CMP $4A,X    ! compare with first val in TABLE
03D4   F0 06        BEQ $03DC    ! if equal then goto 03DC
03D6   E8           INX          ! if not equal increment counter
03D7   E0 10        CPX #$10     ! checked all 16 yet?
03D9   D0 F7        BNE $03D2    ! if all checked, but no match is made,
03DB   60           RTS          ! then return to BASIC..something wrong.
03DC   8A           TXA          ! get position of matched val in TABLE
03DD   05 48        ORA $48      ! logical OR with quadrant number
03DF   AA           TAX          ! put result in X
03E0   B5 4A        LDA $4A,X    ! get corresponding value from TABLE
03E2   A2 00        LDX #$00     ! clear X
03E4   81 01        STA ($01,X)  ! put value into screen location
03E6   60           RTS          ! and return to BASIC
```

FAST GRAPHICS, ctd. from p. 15.....

LISTING 7: Graphics Pac Demo Program

```
 0 REM GRAPHICS PAC DEMO PROGRAM BY WARREN D. SWAN
 10 BASE=826:SI=BASE+40:SD=BASE+63:SW=BASE+108:GR=59468
 20 POKE GR,12:A$="FAST GRAPHIX BY MACHINE LANG. ROUTINES
 30 PRINT"cs":FORI=1TO25:SYS SI:SYS SD:PRINT"ch"A$:NEXT:GOSUB1000
 40 GOSUB200:A$="Fast Graphix by Machine Langrvs.off Routines
 50 SYS SW:POKE GR,14:GOSUB200:FORI=1TO RND(π)*10+20:SYS SW
   :FORJ=1TO200:NEXT
 60 NEXT:FORI=0TO255:A=USR(I):NEXT:A=USR(RND(π)*256):FORI=1TO24
   :SYS SD
 70 GOSUB500:NEXT:PRINTB$:FORI=1TO24:PRINT:GOSUB500:NEXT
 80 RESTORE:POKE GR,12:FORI=1TO4:FORJ=0TO7:READB(J):NEXT
 90 FORK=0TO23:WAIT 59456,32,32:A=USR(B(K AND 7)):FORM=1TO20:NEXT
   :NEXT:NEXT
 100 GOTO10
 200 T$="[ch,12cd]":B$="[ch,24cd]":PRINT"cs":SYS SI
 210 FORI=1TO13:SYS SI:PRINTLEFT$(T$,I)A$LEFT$(B$,26-I)A$;:NEXT
   :GOTO1000
 500 FORJ=1TO100:NEXT:RETURN
 1000 FORK=1TO323:NEXT:RETURN
 9000 DATA 101,84,71,66,93,72,89,103
 9010 DATA 100,82,70,64,67,68,69,99
 9020 DATA 103,89,72,93,66,71,84,101
 9030 DATA 99,69,66,67,64,70,82,100
```

In this listing, cs means clear screen, ch means cursor home, rvs means the reverse key, off means shift of the reverse key. cd means cursor down. [ch,12cd] means a cursor home followed by 12 cursor down characters. [ch,24cd] means a cursor home followed by 24 cursor down characters.

RAMBLIN'

HOW THE CB2 LINE WORKS...

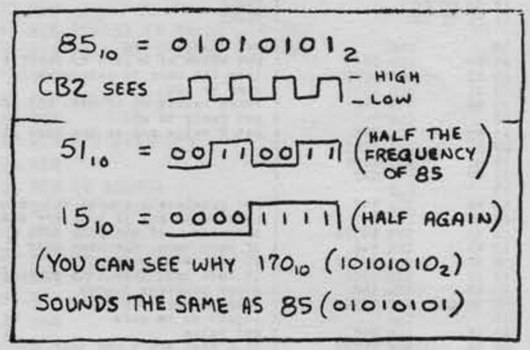
CB2 IS ONE CONNECTION (OF MANY), TO A SPECIAL CHIP IN THE PET CALLED THE VERSATILE INTERFACE ADAPTER (VIA), COMMODORE PART NUMBER 6522.

THE VIA APPEARS TO THE 6502 MICROPROCESSOR TO BE NOTHING MORE THAN A GROUP OF MEMORY ADDRESSES, NO DIFFERENT FROM ANY OTHER RAM REGISTERS; ACCEPTING AND RETURNING 8-BIT BINARY NUMBERS UNDER PROGRAM CONTROL. HOWEVER, INTERNAL CONTROL CIRCUITS IN THE VIA PERMIT A NUMBER OF NEAT THINGS TO HAPPEN.

FOR INSTANCE, VIA ADDRESS 59466 IS A SERIAL I/O SHIFT REGISTER. IF YOU PUT DECIMAL 85 IN IT...

(POKE 59466, 85)

... IT WILL THEN CONTAIN BINARY 01010101.

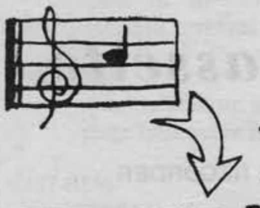


$85_{10} = 01010101_2$

$51_{10} = 00110011$ (HALF THE FREQUENCY OF 85)

$15_{10} = 00001111$ (HALF AGAIN)

(YOU CAN SEE WHY 170_{10} (10101010_2) SOUNDS THE SAME AS 85 (01010101)



	FREQUENCY Hz	SHIFT RATE 59464	BYTE SHIFTED 59466
A	880	140	51
G	784	157	51
F	698	177	51
E	656	188	51
D	587	211	51
C	523	237	51
B	494	251	51
A	440	140	15
G	392	157	15
F	349	177	15
E	330	188	15
D	294	211	15
C (FORMULA ↓)	262	237	15
$SR = \frac{62500}{F} - 2$	$\hat{F}$	$\hat{SR}$	$\hat{15}$

NOW, IF YOU POKE VIA ADDRESS 59467 WITH 16, IT WILL SET UP A FREE-RUNNING CONDITION, IN WHICH THE BITS IN 59466 ARE SHIFTED OUT "ENDWISE" ONTO THE CB2 LINE WHICH, IN OUR EXAMPLE, WILL CAUSE CB2 TO GO ALTERNATELY HIGH AND LOW AS THE ONES AND ZEROS GO BY. YOU CAN HEAR THIS AS A TONE THROUGH AN AMPLIFIER HOOKED UP TO CB2.

WHAT PITCH? WELL, THAT DEPENDS ON WHAT NUMBER IS POKED INTO 59464, A VIA REGISTER WHICH KEEPS TRACK OF THE TIME. THE BIGGER THE NUMBER, THE LOWER THE PITCH.

-O'B

MISCELLANY

Roy O'Brien

Well, everything else in this issue is put to bed; this column is the last thing. It's been an experience, and I can't imagine how Gene did it. I offered to help him, since I have a connection with a typing-typesetting-office services business which is pretty well equipped, but without their facilities it's gotta be a difficult job.

This time around, and probably next, the mailing labels are being done on a copier, but when we get one of the new printers, they'll be done via PET cassette files. Eventually, I hope to have a disc system up, to do both the mailing list and word processing. We have the CMC word processing program (which we've never had a chance to use) and will be looking for a mailing list program. Anybody got any recommendations?

We'll also be glad to have the printer to do the program listings, complete with cursor controls and graphics characters. Even in the big magazines, when a program is typeset, there are almost always errors, and you've got to be pretty experienced (as I am not) to debug 'em. It's hard to beat the idea of having a program up and running, checked out, then dumping a LIST to the printer. Meanwhile, as you can see, we're going with whatever the article author sent, as being more likely to be correct than a retyped version.

Incidentally, as it says elsewhere, if any of the listings are too small or unclear, drop a line to get full-size copies. One stamp per two-sided sheet will keep the books balanced.

A lot of the User Group mail contains comments or requests regarding machine-language information. We had planned the first of a tutorial series on machine code for this issue, but it got bumped (ironically) by a couple of really good machine-language programs. Look for it next time. I tend to share Gene's feelings on not including a lot of reviews, but will try to do one on the Abacus Machine Language Guide. If you've got it, I'd appreciate a postcard or note with your comments.

I recently got a chance to fulfill a long-time ambition, and attended the April SPHINX meeting. They meet in the Mr. Calculator store in downtown San Francisco, and it turned out to be the same sort of friendly pandemonium I've become accustomed to at the New Jersey Computer Club. Since many of the best programs in the NJ Club Library (and the Cassette Exchange) came out of SPHINX, I was glad to meet Jim Page, their tape librarian. We've agreed to get together soon for a full session of cross-pollinating our respective tape libraries.

While there, I picked up a copy of a flyer by Harry Saal (author of MAXIT, among other things), announcing an interesting product he's come up with. It's a 2K add-on ROM, which plugs into the expansion port, and provides the following additional commands to PET's BASIC ROM:

AUTO: enter autonumbering mode, with the PET providing evenly spaced line number prompts

APPEND: appends a BASIC program from tape to the program in storage—using normal SAVEd tapes

DELETE: deletes a range of lines as easily as LIST

DUMP: displays the names and values of variables in the symbol table during or after running a program

HELP: used after an error in BASIC to display the erroneous line, with the offending taken highlighted

RENUMBER: renumbers a BASIC program (and all references) by specified stepsize

TRACE: lets you see the line numbers of statements as they are executed, in a small scroll window in the corner of the screen. Also operates in single STEP mode

Harry calls it the BASIC PROGRAMMERS TOOL KIT, and is selling it for $75. If you want more info, write Palo Alto IC's, 810 Garland Drive, Palo Alto, CA 94303.

Incidentally, the reason you haven't gotten a recent issue of the SPHINX Newsletter is that they've run into a temporary snag of some sort. Something to do with the funds being deposited with the University Regents and red-taped to a standstill. Milt Lee says they expect to get something going soon.

The Cassette Exchange (p. 3) contains KEYBOARD, a program originally written by Neil Harris to turn the PET keyboard into an organ, later modified by Jim Butterfield to include a record/playback feature. (By the way, we have a little instruction sheet with directions and cutout graphics to make an overlay for the PET keyboard which gives you the black and white keys in their proper positions to go with the program.) Anyway, the program aroused my ignorance of music to the point where I started shopping around for an instrument to fool with, which led to a lot of reading and discussion regarding synthesizers.

Turns out most of them have a simple tone generator, which produces the same kind of signal KEYBOARD puts out onto the CB2 line, which is then shaped (or bent, or broken, if you prefer) by analog circuitry. The shaping and filtering of the basic tone is triggered by a pulse emitted by the tone generator at the start of the tone. Well, if the PET can be made to put out a similar pulse on one of its other I/O lines at the start of a tone (as I'm sure it can), then a very simple righ will put you into the far-out music business. I've sent to PAIA for further info on their GNOME microsynthesizer, which sells for fifty bucks or so, and it looks to me as though it ought to hook up to the PET just fine. Will keep you posted.

The other side of the coin is that the whole analog end may be unnecessary, if you have a digital to analog (D/A) converter and appropriate software. Had a talk with Hal Chamberlin recently, much of which I couldn't understand, but Hal and others who are working in this area are looking forward to some interesting developments.

Speaking of developments, at the April NJ club meeting Joanathan Greif gave me a "preliminar' copy of a music program he's working up. Like KEYBOARD, you can record a tune on the PET keyboard, but when it plays back, the screen first shows a blank musical staff, complete with G-clef, and as each note is played, it pops into its proper place on the staff. Jon says he's going to call it MUSICREADER, but I thing MUSICWRITER would be more appropriate. Boy, I sure hope Commodore starts shipping printers soon!

MEMORY TEST

Jerry A. Velders

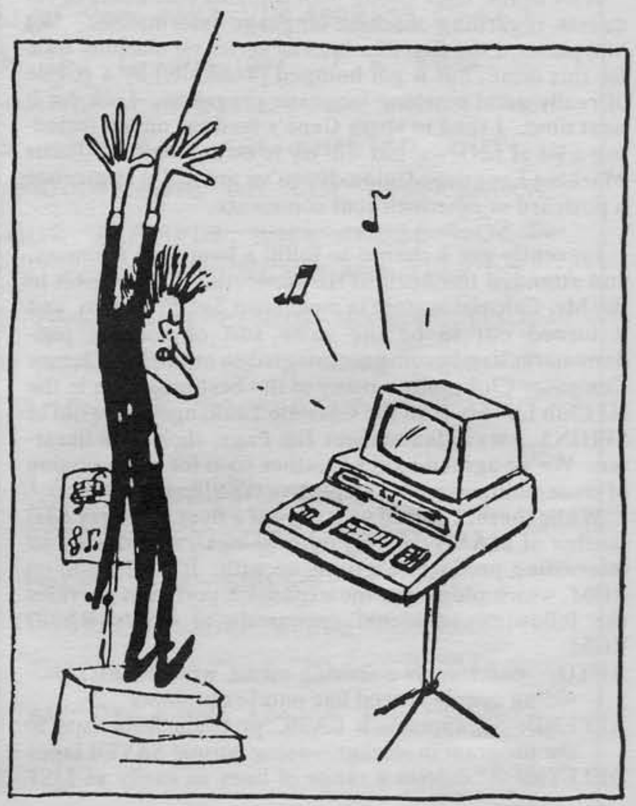
MTEST is a non-destructive machine language memory testing routine which was built around the PET but which could be easily adapted to any 6502 based machine. In this version the test routine resides in the second cassette buffer (HEX 033A or DEC 826) and occupies 52 bytes of memory. I am enclosing a BASIC program which loads MTEST and then supports its operation, allowing user specification of starting address; and is easily modified to work on any amount of contiguous memory.

The BASIC program loads MTEST and then prompts the user for the starting location in decimal, after which it jumps via SYS 826 to the test routine. Each consecutive byte is loaded with 0 through 255 and checked to see that it reads back correctly. Prior to testing each byte, the original contents are saved in location 70(DEC) and after the test the contents are restored. This is what makes it possible to jump back to the BASIC program after the test is complete. Memory locations 1 and 2 (normally used by the USR statement) are used as indirect pointers to the byte being tested, so if a bad byte is encountered the test branches back to BASIC, saving the address of the bad location in 1 and 2.

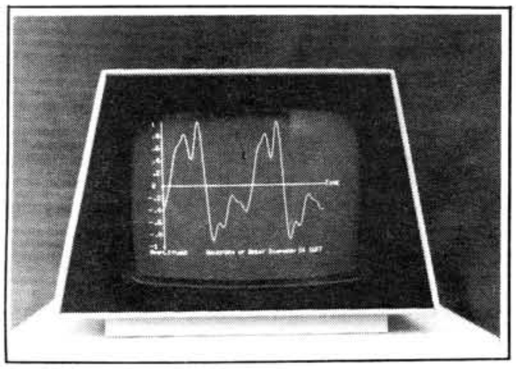
Once the BASIC program is loaded, it is no longer necessary to the operation of the test routine, although it is a little more convenient. Since the second cassette buffer is a protected location you can load and save and run BASIC programs while the test routine is tucked safely away. To test memory without the supporting BASIC program, simply POKE 1 and 2 with the low and high addresses of the starting point of the test and SYS 826. When control is transferred back to BASIC, PEEK locations 1 and 2 for the ending address—which will be either the top of memory in you system or the address of a bad byte. Pressing any key while the test is running will stop the test and transfer control back to BASIC.

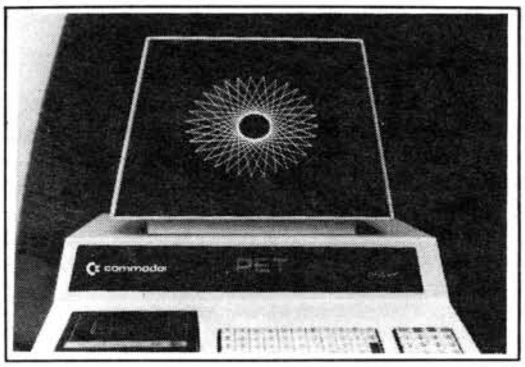
```
 5 REM MTEST  JERRY A VELDERS
 8 FOR K=826 TO 877:READ D:POKE K,D:NEXTK
 10 PRINT"ENTER START LOCATION IN DECIMAL"
 15 PRINT"(DON'T START BELOW 1024)"
 20 INPUT S
 25 PRINT"WORKING...
 30 SH=INT(S/256)
 40 SL=INT(S-(SH*256))
 45 TI$="000000"
 50 POKE 1,SL:POKE 2,SH
 60 SYS826
 65 EN=PEEK(2)*256+PEEK(1)
 70 PRINT"TEST STOPPED AT ";EN
 80 IF PEEK(2)=32 THEN PRINT "MEMORY OK"
 85 T=TI/60
 88 PRINT"EXECUTION TIME =";T;"SECONDS"
 89 PRINT (EN-S)/T;"BYTES/SECOND"
 90 END
 100 DATA 160,0,162,0,161,1,133,70,152,129,1,193,1,208,36
 105 DATA 200,208,246,165,70,129,1,24,165,1,105,1,133,1
 110 DATA 165,2,105,0,133,2,169,0,32,228,255,208,9,165,2
 115 DATA 201,132,240,3,76,62,3,96
READY.
```

```
033A   A0 00   LDY #0       ! clear Y reg(used as counter for test data)
033C   A2 00   LDX #0       ! clear X reg
033E   A1 01   LDA (1,X)    ! load acc with contents of 1st test byte
0340   85 46   STA 70       ! store in loc. 70 (dec)
0342   98      TYA          ! transfer test number to acc
0343   81 01   STA (1,X)    ! store in test loc
0345   C1 01   CMP (1,X)    ! compare with original
0347   D0 24   BNE $036D    ! if byte is bad, return to BASIC
0349   C8      INY          ! if test ok, increment test counter
034A   D0 F6   BNE $0342    ! and try it for the next number
034C   A5 46   LDA 70       ! when counter returns to 0, get original
034E   81 01   STA (1,X)    ! contents and restore them
0350   18      CLC          ! get ready to increment test address
0351   A5 01   LDA 1        !
0353   69 01   ADC #1       ! add 1 to low address
0355   85 01   STA 1        ! and store in loc 1
0357   A5 02   LDA 2        !
0359   69 00   ADC #0       ! add 0 to high address
035B   85 02   STA 2        ! and store in loc 2
035D   A9 00   LDA #0       ! clear acc
035F   20 E4 FF   JSR $FFE4    ! see if any keys have been pressed
0362   D0 09   BNE $036D    ! if so, return to BASIC
0364   A5 02   LDA 2        ! load acc with high address
0366   C9 84   CMP #132     ! see if test has come to end of memory
0368   F0 03   BEQ $036D    ! if so, return to BASIC
036A   4C 3E 03   JMP $033E    ! if not, test next address
036D   60      RTS          ! return to BASIC

Note:- Operands are decimal unless preceded by $ (hex)
     - # denotes immediate addressing
     - (1,X) denotes indirect addressing, indexed by X
     - The CMP instruction in line 0366 is set for my system with
           32K of memory + 1K screen RAM, all contiguous, but works
           OK on the basic 8K PET without modification.
     - Testing the video RAM (start at 32768) makes a nice, but
           brief, show.

 Final note: Typing this out is a real pain.  Anybody have any
      info on interfacing PET with a Singer 2303 Flexowriter?
```



REAL GRAPHICS FOR PET





How would you like to display some REAL graphics on your PET computer? Real graphics such as finely detailed mathematical curves or perspective drawings or computer art or proportionally spaced text or whatever directly on the PET screen. Graphics in which each individual dot in a huge 64,000 dot array 320 wide and 200 high is INDIVIDUALLY controllable. As a bonus, how would you like an extra 8K of memory when super graphics were not being used?

At last the famous MTU VISIBLE MEMORY available to KIM-1 users for well over a year is now available with an adaptor for the PET. The K-1007 PET-to-MTU adaptor plugs into the PET expansion connector and includes a cable and edge socket assembly which will accept our K-1008-PET Visible Memory board. Most all of the assembly can be hidden inside the PET if only the Visible Memory is used or the unit can be plugged into our K-1005 motherboard/card file for further expansion with other advanced design MTU boards. Use of the K-1007 does not tie up the PET's expansion port however.

Besides the bus adaptor, the K-1007 contains video processing circuitry to translate standard Visible Memory composite video into the form required by the PET monitor although composite VM video is still available for an external CCTV monitor. An on-board latch allows software switching between standard PET video and VM video. All necessary operating power is taken from the PET transformer but as most of our customers know, MTU boards require very little power for operation.

K-1008-PET $243.00 K-1007 $79.00

ALSO REAL 4 VOICE MUSIC

By now you have probably heard of the "DAC music system" for the KIM-1 that was pioneered by Hal Chamberlin in association with MTU. Up to 4 independent, simultaneous musical voices, each with an independent waveform, can be synthesized for true 4-part harmony. While software is the key to such performance, our K-1002-3C software package allows most of the potential of the technique to be realized on a standard 8K PET.

We have now redesigned the original DAC board specifically for the PET. The K-1002-2A operates from a single 5 volt power supply and includes an accurate 8 bit digital-to-analog converter, sharp 6 pole low-pass filter, and audio power amplifier usable with any kind of speaker. The board plugs directly onto the PET user port and second cassette port for power yet all signals feed-through to a second set of board edge fingers.

K-1002-2 $50.00 K-1002-3C $20.00

WANT MORE EXPANSION YET?

K-1005 5 Slot Card File $75.00 K-1016 16K Low Power Memory $340.00
K-1012 24K PROM, PROGRAMMER, I/O, COMM $237.00
K-1020 Prototyping Board $42.00

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Son of 'DISABLING THE PET STOP KEY'

Jim Butterfield

1. Credit: adapted from an unknown source which later proved to be Richard Tobey of SPHINX.
2. New method: the STOP key and the clocks (TI and TI$) may be disabled with this simple POKE statement: POKE 537,136. They may be restored with POKE 537,133. This new method was discovered by Steve Punter of Toronto.
3. As previously noted, the Tobey method Must be disabled before I/O activity can take place (tape read or write, or IEEE-488 activity).
   The new Punter method does not prevent I/O. However, it must be noted that any such activity (e.g., OPEN, CLOSE, PRINT#, SAVE, etc.) will restore normal operation of the STOP key, so that 537 must be POKEd again.
   There does not seem to be any method of disabling the STOP key during I/O activities.

Ed. Note: Jim's original article "Disabling the PET Stop Key" appeared in Vol I issue 6 of the Notes. —O'B

FOUR-LINER DEP'T...

Richard Larson

Here is another fascinating four-liner your readers may enjoy. It selects a random character and fills a 25 x 26 square at the center of the screen using a spiral motion. Then it unwinds with a randomly selected reverse character.

As written, alphabetic characters are suppressed. To allow these characters, change the value of C in line 1 to read: C=RND(1)*128−(Q=2)*128. Also a clear screen could be squeezed into line 1.

Maybe I should add the warning that this program may be hypnotizing.

```
 1 C=RND(1)*101+27-(Q=2)*128:IFP=0THENB=
33267:E=33760:P=B:R=1:W=-40:N=-1:Q=-2

 2 S=-(Q=2):X=W:W=-N:N=-X:Q=-Q:X=R:R=L:
L=X:IFP=BTHENPOKE B,C

 3 FORA=STOR:P=P+W:POKEP,C:NEXT:FORA=STO
R:P=P+N:POKEP,C:NEXT:IFP>EORP=BGOTO1

 4 FORA=STOL:P=P-W:POKEP,C:NEXT:FORA=STO
L:P=P-N:POKEP,C:NEXT:R=R+Q:L=L+Q:GOTO3
```

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