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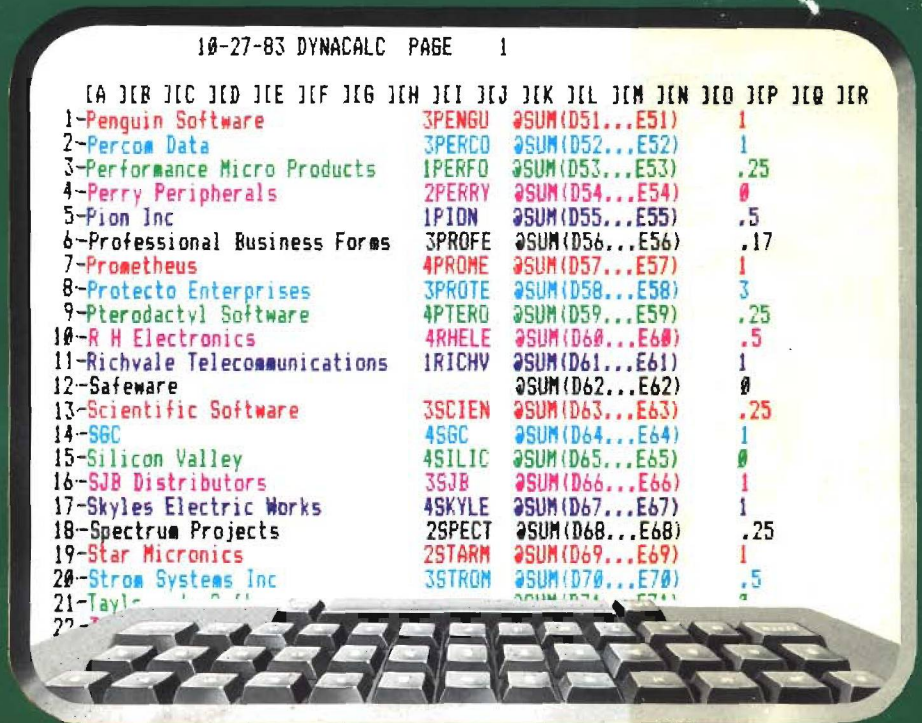
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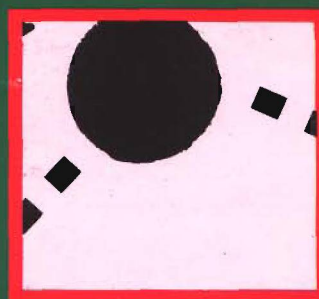
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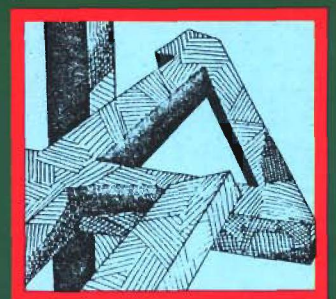
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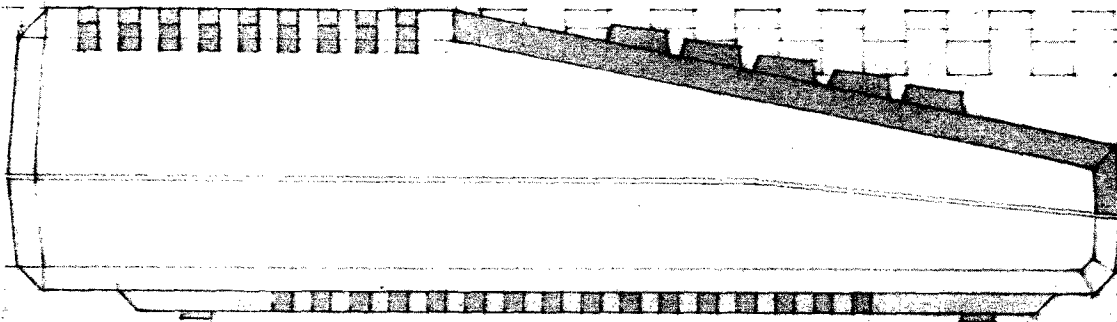
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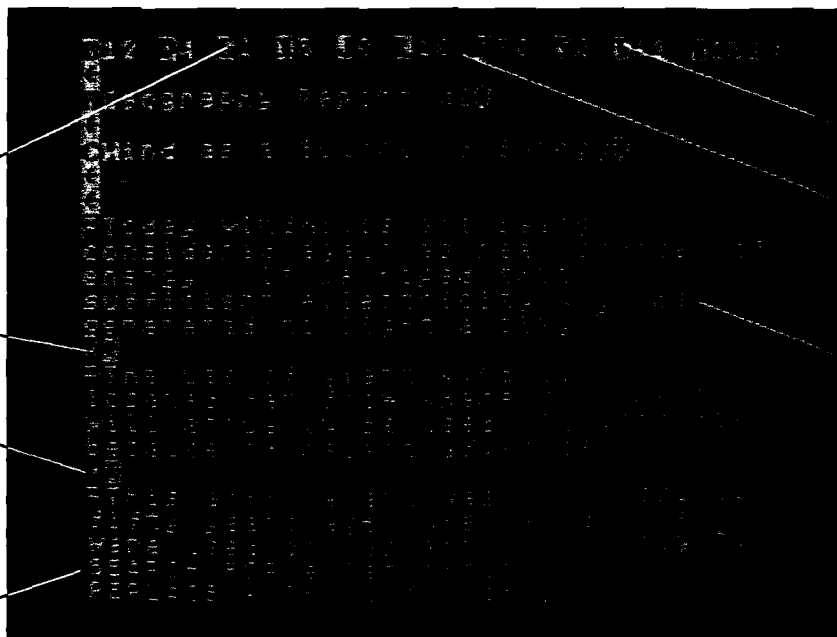


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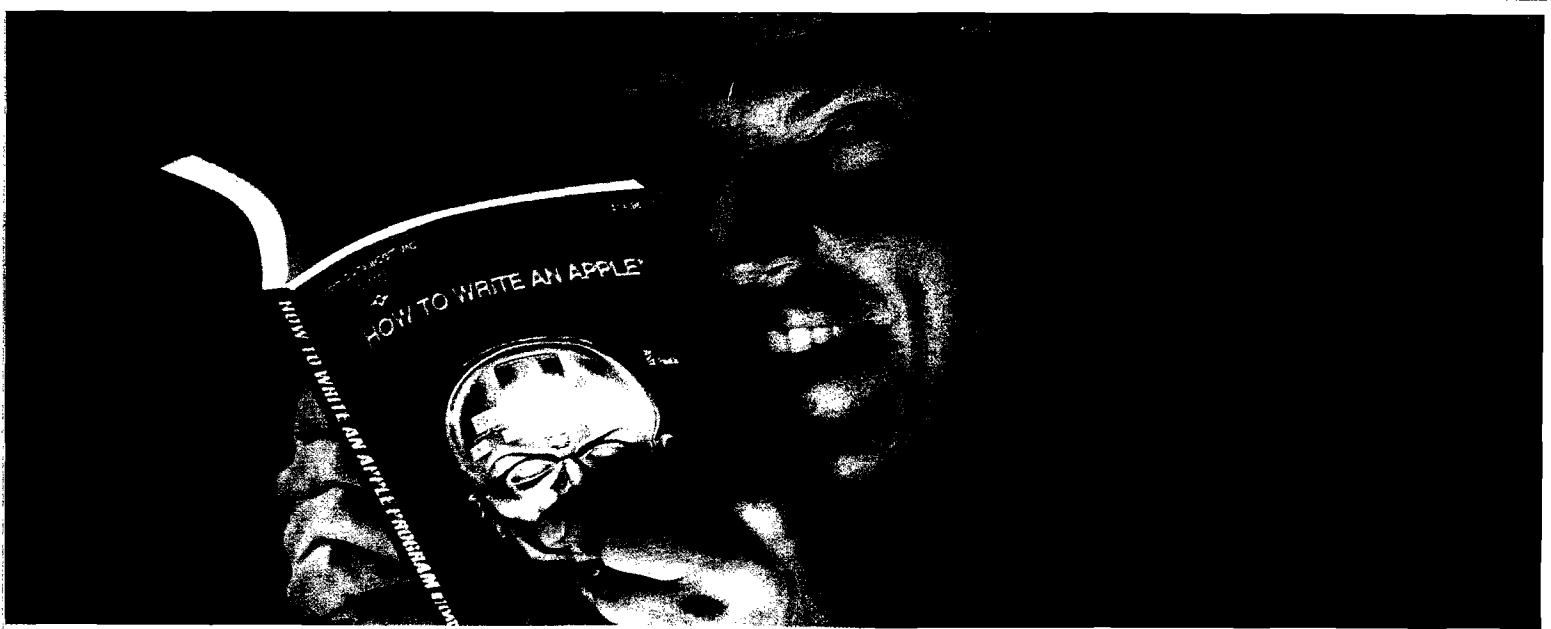
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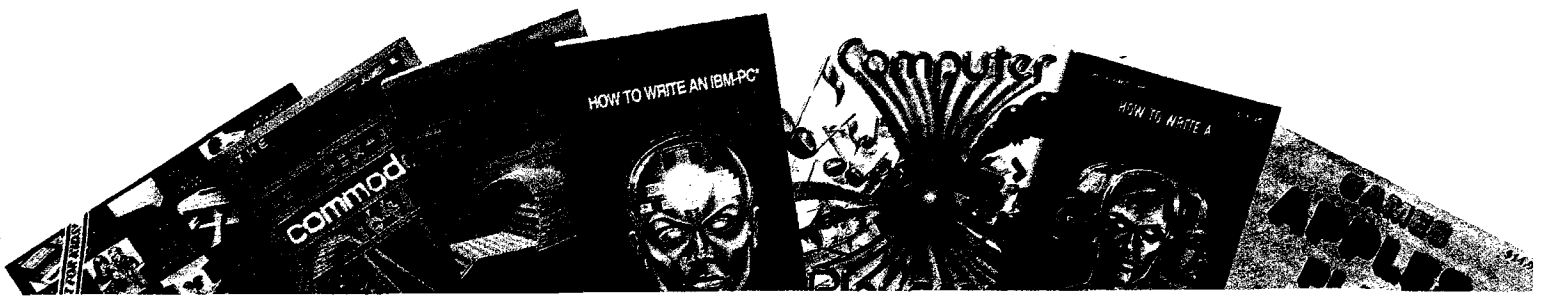
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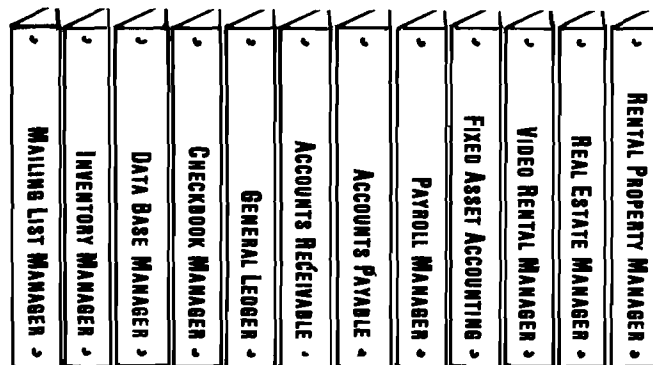
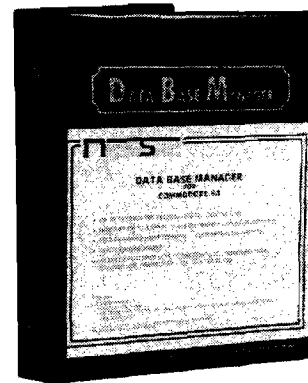
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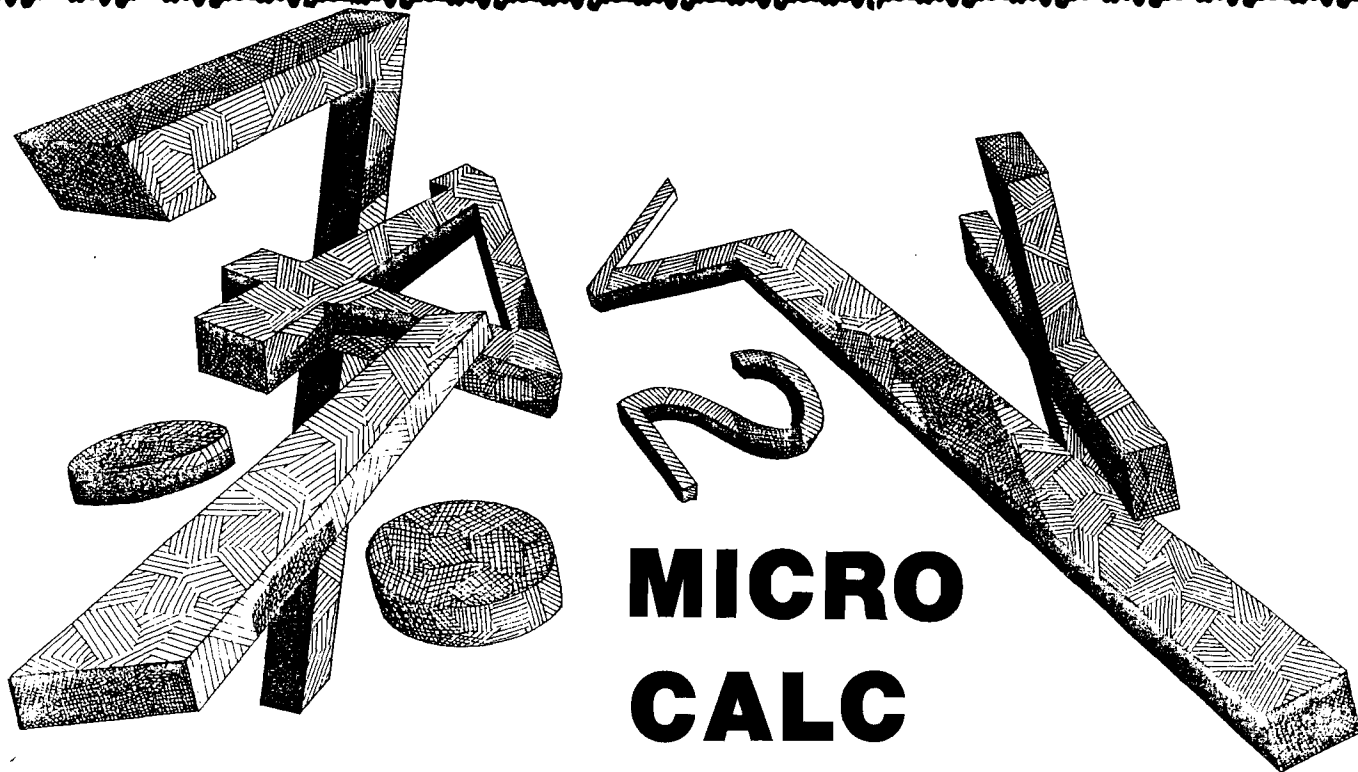
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# MICRO CALC

by Loren Wright

## Micro Calc — What is it?

**M**icro Calc is a calculation program, not entirely unlike the spreadsheet programs described elsewhere in this issue. It is much simpler than a program such as VisiCalc, and that simplicity results in both advantages and disadvantages. This is not a spreadsheet program, so it is limited to much simpler calculations. However, as you will see from some of the examples presented later, there are many applications for such a quick calculational aide. All you need to know is the rules for BASIC arithmetic expressions.

In this issue we offer a ten-line version for an unexpanded VIC-20 with cassette. We also offer a 15-line version for the TRS-80 Color Computer, 20-line versions for the Commodore 64, PET, and Atari 400/800/1200, and a 23-line version for the Apple.

## Haven't I seen this before?

The ten-line version was first presented in the March, 1982, issue of MICRO. A number of typographical errors in that listing have been corrected, and there have been several improvements. The VIC-20 version now includes the following additional features:

- ✓ multiple statements on a line

- ✓ convenient implementation of programmable function keys
- ✓ optional zeroing of user variables

The Apple, Commodore 64, and PET versions have added:

- ✓ multiple statements on a line
- ✓ function key implementation (C-64)
- ✓ optional zeroing of user variables
- ✓ disk support, with file name display
- ✓ error trapping (Apple)
- ✓ a total of 20 lines for calculations
- ✓ separate comment lines, one opposite each calculation line

The Atari version, presented here for the first time, allows *limited* use of IF...THEN, FOR...NEXT, and other BASIC constructions. The Color Computer version, also new, provides 15 lines for calculation, multiple statement capability, and file name display.

## How to Use Micro Calc

See the article in each section of the magazine for listings and specific instructions. Below are general instructions.

RUN the program. The screen will fill with a sample screen. This is designed to calculate the monthly payment on an installment loan. On the Commodore 64 and the VIC-20, press the F7 key; on the others press the "@" key. The cursor will disappear for a few seconds, and then a number will appear

next to the P? on the last line. This is the monthly payment calculated on an \$8000 loan for 48 months at 11.9%. You may now move the cursor to the end of any line and delete and retype to try a different calculation. See what happens if the loan goes for only 36 months, or at only 9.9%, or if you decide to borrow \$10000.

There are two kinds of statements allowed — *assignment* and *value request*. An assignment takes the following form:

[variable] = [BASIC numeric expression]

where [variable] is any single-letter floating-point variable name.

A value request takes the following form:

[variable]?

Typical assignments include:

X = 5  
A = X + 3  
J = SIN(X + 3 \* A)  
P = Y = 5

Assignments may be combined on a single line by using semicolons or colons (see instructions for your implementation):

A = 5; P = 3.14159265; Z = PI

A=  
 M=  
 I=  
 I=I/1200  
 D=(1-(1+I)^-M)/I  
 P=A/D  
 P=INT(P\*100+.5)/100  
 P?

**PAYMENT:** Calculates monthly payment, given starting balance A, number of months M, and annual interest rate I.

K=  
 F=3280.8336\*K  
 F?  
 M=INT(F/5280)  
 G=F-M\*5280  
 F=INT(G)  
 I=INT((G-F)\*12+.5)  
 M?  
 F?  
 I?

**METRIC CONVERSION:** Converts kilometers to miles, feet, and nearest inch.

T=  
 U=  
 C=  
 P=3.14159265  
 V=180-T-U  
 V=P\*V/180  
 U=P\*U/180  
 B=SIN(U)\*C/SIN(V)  
 B?

**SOLVE TRIANGLE:** Calculate a second side of triangle, given two angles (in degrees) and included side.

A=  
 B=  
 V=  
 V=3.14159265\*V/180  
 D=A^2+B^2  
 E=2\*A\*B\*COS(V)  
 C=SQR(D-E)  
 C?

**SOLVE TRIANGLE:** Calculate third side of triangle, given two sides and included angle.

Value requests may not be combined with any other statement on one line.

## How it works

The Micro Calc program is written almost entirely in BASIC. None of the floating-point variables named with a single letter is used in the program itself. This allows the user all 26 of these variables on the screen. When the F7 or "@" key is pressed each assignment statement is POKEd into a special area of memory called the input buffer. Then a BASIC ROM routine is called to tokenize the expression. Finally another ROM routine that assigns variables (the BASIC LET function) is called to evaluate the expressions. With the Commodore versions, the machine code is only 48 bytes.

The Atari version works a little differently. It uses an alternate screen on which you do your typing. Then, when you press the calculate key ("@"), the lines you have typed are copied to the actual BASIC screen (which is kept hidden from the user) and RETURNS are executed on each line to execute the statements in the immediate mode.

Atari BASIC is quite different from the BASICs on the other computers. The discussion below applies primarily to these other computers. Many of the things discussed will not work on the Atari. The Atari version has extra powers, such as IF...THEN and FOR...NEXT support, though. See the Atari section for details.

## When to Clear the Variables

The latest version of Micro Calc allows you to clear the variables at your discretion. This process is only done automatically when the screen is cleared or when a screen is SAVED or LOADED. What are the advantages? If you type in the screen marked "DISTRIBUTE", you will see a good reason why the variables aren't cleared automatically on each calculation. Notice that the line labeled "BALANCE" at the top of the screen assigns a value to the variable B. This is where you type in the starting balance for your loan. The final calculation results in a new value for B. If you now go to the end of the top line and delete it entirely, the calculation will be performed using the B calculated in the *previous* calculation. Without automatic recalculation, variable M acts as a counter, incrementing once

each time the calculation is repeated. If the first line is left intact, though, the same calculation will be repeated, and, assuming nothing is changed, all the variables except M will come up with the same values as the previous time. If you want to zero M, you can just hit the zeroing key (F8 on C-64 and VIC, double quote on the Apple, and CLEAR on the CoCo), or you can explicitly assign M a value of zero as part of a multiple statement on the first line.

## Making a Decision without IF...THEN

The "DEC-TO-HEX" screen demonstrates how to make decisions without using IF...THEN (which is not allowed in Micro Calc). The problem we want to solve is how to get the same screen to work on both signed and unsigned decimal integers. There are two ways to look at a 16-bit binary number. If *unsigned* arithmetic is used, all 16 bits are used, so 1111 1111 1111 1111 is considered to be the equivalent of the decimal number 65535. If *signed* arithmetic is used, the most significant bit indicates whether the number is positive or negative. If the bit is on, the number is negative and the absolute value is determined by taking the two's complement. This same binary number that is 65535 in unsigned arithmetic is -1 in signed arithmetic.

The solution is to test for positive or negative within an arithmetic expression. This is done in the line labeled "SIGNED". The expression  $D < 0$  tests whether the original decimal number is negative. If it is, -1 is assigned to the expression, it's multiplied by -16, and 16 is added to the value of H, which is negative. What this really accomplishes is taking the two's complement of the most significant hex digit whenever the original decimal number is negative. The other three hex digits are calculated properly, whether the calculation is signed or unsigned. The Apple and Atari assign 1, instead of -1, to a true statement, so your calculations should reflect the difference. In this example, you would type  $H = H + (D < 0) * 16$  for the Apple or Atari. This decision making capability is used similarly in the "HEX-TO-DEC" screen. The variable S is used as a flag: if it is less than 0, then the result is calculated as signed; if it is 0 or greater, then the result is calculated as unsigned. The same change must be made for Atari or Apple screens. Other

applications of this decision-making ability would be testing a divisor to avoid a fatal ?DIVISION BY ZERO ERROR, and testing a counter to see if it has arrived at a specified maximum.

## Getting More into Less Space

The Color Computer and VIC-20 versions of Micro Calc offer less space for calculation due to memory or screen-size limitations. On the VIC-20, each line is only 20 characters long, and on both computers there are fewer lines available. Two techniques may be used to get around these limitations.

*Multiple statements* may be used to perform two short assignments on the same line. For instance, in the "HEX-TO-DEC" screen, the statements  $D = D + J * 16$  and  $D = D + K$  may be combined into one line by separating them with a colon (semicolon on Commodore machines):  $D = D + J * 16 : D = D + K$ .

Statements that are too long to fit on one line may be broken into two separate statements by using an *intermediate result*. For instance, the statement  $J = \text{INT}(I * D * B * 100 + .5) / 100$  may be replaced (as it was in the "DISTRIBUTE" screen) with two separate statements:  $J = I * D * B$  and  $J = \text{INT}(J * 100 + .5) / 100$ .



## Micro Calc Program Description

### Notes on all programs

Of necessity, all of the comments in the following description do not necessarily apply to all of the programs. The reader is cautioned to take such comments as 'color' to apply only if your computer has the specified function.

### Initialization (A)

The screen is cleared and the border and screen color set. The call to subroutine, READs in the bytes of the machine language program from the DATA statements and POKEs them into memory. A number of constants are defined, including the carriage return, delete, and other control characters. The number of lines is set and the arrays are dimensioned accordingly. A subroutine is called, which fills the arrays from the remaining DATA statements to make the sample



START BAL	B=
DAYS/PER.	D=
PAYMENT	P=
ANN %	I=
DAILY DEC	$I=I/36500$
INTEREST	$J=I*D*B$
(ROUND)	$J=INT(J*100+.5)/100$
TO PRINC	$C=P-J$
(ROUND)	$C=INT(C*100+.5)/100$
COUNTER	$M=M+1$
TO INT.	J?
TO PRINC.	C?
# PERIODS	M?
	$B=B-C$
NEW BAL	B?

The following screens require more than ten lines. See the text for techniques to squeeze more assignments into less space.

**DISTRIBUTE:** Calculate distribution of monthly payment to interest and principal. Enter the requested values for the starting balance B, days/period D, payment P, and annual interest rate I. To continue beyond the first month, perform the calculation once, then delete the first line. The new balance will be retained as the starting balance for the next calculation. The counter M will increment once for each calculation.

DEC INPUT	D=
MS DIGIT	$H=INT(D/4096); I=D-H*4096$
	$J=INT(I/256); K=I-J*256$
	$L=INT(K/16)$
LS DIGIT	$M=K-L*16$
SIGNED?	$H=H-(D<0)*16$
10=A	H?
11=B	J?
12=C	L?
13=D	M?
14=E	
15=F	

(Commodore use ;)

(Atari and Apple use:  
 $H = H + (D < 0) * 16$ )

**DEC-TO-HEX:** Calculate hexadecimal equivalent of decimal integer in the range -32768 to 65535.

MS DIGIT	H=
	I=
	J=
LS DIGIT	K=
	$D=H*4096$
	$D=D+I*256$
	$D=D+J*16$
	$D=D+K$
SIGNED?	$D=D+(H<0)*65536$
DECIMAL	D?
A=10	
B=11	
C=12	
D=13	
E=14	
F=15	

(Atari and Apple use:  
 $D = D - (H < 0) * 65536$ )

**HEX-TO-DEC:** Calculate decimal equivalent, given four-digit hex number. To interpret as negative number, precede first digit with - sign.

screen. The sample screen is displayed. Then the cursor is positioned for the first line, and a branch is made to enter the normal loop. If you want to skip loading the sample screen, delete the appropriate line.

### **Main Program Loop (B)**

In general, the program consists of testing for characters from the keyboard. Certain characters are considered to be *control* characters and must be dispensed with in special ways. Some of these involve branching to subroutines; others are dealt with immediately. Characters that aren't control characters are either accepted and added to the end of the current line, or they are rejected. After each character is processed, the flow usually goes back to the main loop. If the next character begins a new line, then a branch is made to reposition the cursor.

Whenever the screen is cleared, the arrays are cleared and the screen blanked. If the new line contains a value request statement, then the line is blanked out to remove the printed value. The current line is printed, followed by the cursor. Characters from the keyboard are processed. Control characters are tested and other characters are added to the current line.

If the character causes the length of the line to be exceeded, then a cursor down or return is executed. Then the line number counter is incremented and tested. If maximum lines has been exceeded, then the necessary adjustments are made to start work on the first line. Otherwise, the cursor is positioned at the beginning of the next line.

Delete is handled by checking for an empty line. The necessary screen display parameters are set, and strings are adjusted with the `LEFT$( )` function.

The up-cursor character is handled in the following manner. If the new line is 0 then the line counter is set to maximum lines, and the cursor is adjusted accordingly. Otherwise, the cursor is moved up one line.

The calculation command branches to a subroutine which handles the calculation and printing the results. The cursor is positioned at the end of the top line after the calculation.

### **Comment Field Handling (C)**

The operation here is very similar to that of the calculation field. Things are simpler, though, since nearly every

character is allowed. Everything is printed in light green, and the remainder of each line is left unreversed.

### **Input Subroutine (D)**

This is called by the main editor program. The various control characters are tested, then for the other characters. Acceptable ones cause return, while unacceptable ones fall through to get another character. This continues until an acceptable character is received.

### **Calculation Processing (E)**

The calculation process may take several seconds, depending on the screen contents. Each line is examined with value request statements handled by one subroutine. The requested variable is placed into the appropriate element of the string array. An illegal line, with fewer than three characters, is skipped. Other lines are handled by the subroutine where the values are assigned by the machine language routine.

### **Assignment Handling (F)**

Each assignment line is POKED into the input buffer, character by character. Whenever a colon (semicolon) is encountered, that line is processed (a zero is POKED for the Commodore programs). When the end of the line is reached, the machine-language routine is executed, and the RETURN goes back to the calling routine.

### **Get Character (G)**

The GET function accepts any character from the keyboard. If there is no character, then the program loops until there is.

### **File Handling (H)**

The subroutine handles SAVEing the calculation and comment arrays. Similarly, the LOAD subroutine handles loading these arrays from tape or disk. Some of the programs check for disk errors and print error messages or allows a new file name.

The prompt portion sets up a number of variables according to the responses. A disk or tape variable is set and appropriate file name strings established to either READ or WRITE a sequential file. Then the proper channel is opened and the arrays either read from or written to the output device. (The Commodore routine includes an additional subroutine to reread the

machine-language routine back into the cassette buffer, since all or part of it was destroyed during the file operation.) Then the screen is redisplayed, containing the old contents if it was a SAVE operation, and the new contents if it was a LOAD.

### **Value Request Processing (I)**

As each line is processed in the subroutine, only lines ending in a "?" are sent here. Therefore, the first character is the variable name. Each letter is converted into a number from 1 to 26. Flow of control is passed by the ON...GOSUB structure with 26 possible branches. The rest of this subroutine consists of small subroutines, one for each letter of the alphabet. The value of the named variable is assigned to the appropriate element of the value array.

### **Screen Print With Values (J)**

This causes the whole screen to be printed with values shown after each "?". The values are converted to a string using the `STR$( )` function, and the remainder of the line is filled out with the appropriate number of reversed underline characters.

### **Read Machine Language Routine (K)**

The DATA statements contain the individual bytes of the machine-language program. The READ statement is used for each byte, and it is POKED into successive bytes of memory. This routine is called once at the start of the program, and (for Commodore) again whenever a LOAD or SAVE operation takes place.

### **Print Screen (L)**

The first time the subroutine is called, it prints the standard start-up screen. Later, the screen is printed with current array values and comments. Each screen line is printed according to the contents of the arrays. The current file name, if any, is printed at the bottom of the screen.

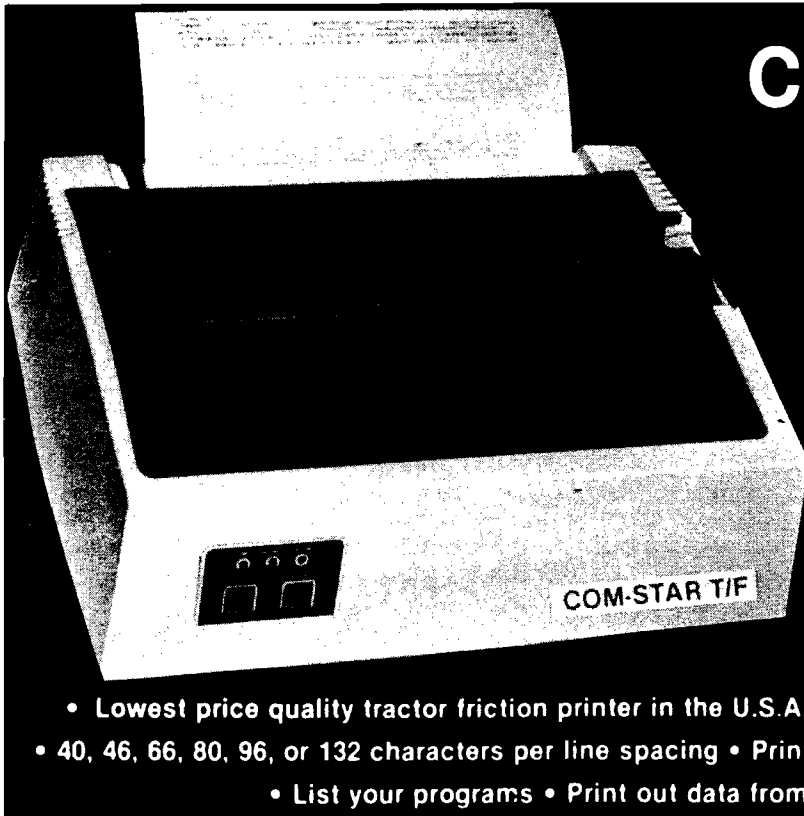
### **Clear User Variables (M)**

Each of the user variables is set to zero. This routine is used when using successive calculations, such as  $A = A + 1$ , to start over with different values.

The rest of the program consists of the DATA statements used for the machine-language program and the initial screen contents.

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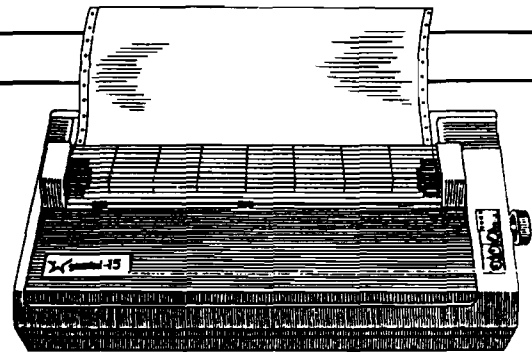
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# Spreadsheets

by Phil Daley

## What does a Spreadsheet Do?

There are many software packages on the market today which have a multitude of uses for business and accounting applications, whether you own a multi-national conglomerate or are managing your own checkbook. Some are fill-in-the-blank accounting programs designed with a specific job or a specific set of jobs in mind. These are usually known as accounting packages: general ledger, accounts receivable/payable, payroll, and others. Many are designed to be general in nature, so that you can program your own particular functions into the software. These are spreadsheet packages that can do accounting functions, as well as act as a mini data-base. Some are designed to be project oriented with specific abilities to organize and layout planning strategies. Others are designed to be multi-purpose with planning and spreadsheet capabilities combined.

This month we plan to concentrate on spreadsheet packages — how do they work, what do they offer and who can benefit from them. While each product has its own syntax and specifications, many of the features can be found on all of the spreadsheet packages and a look at the generic options will give you an overview of what they can do.

The standard display screen is a series of columns (normally designated alphabetically) and rows (normally designated numerically), blank at the beginning. Each intersection of row and column has a name (A1, C67, GG145...). These individual blocks are called "cells".

Each cell can contain one piece of information. You can define the size and type of the individual cells, or whole columns or rows. The size parameter can help save space on the screen by keeping the columns close together. The type parameters (such as Label, Integer, \$, left or right justified...) help prevent input errors and neaten the appearance of the screen format. Each cell can be a number (value), name (label) or computation (formula). Values can be positive or negative, integer quantities or floating-point constants; labels can be names or numbers; formulae can contain any of the allowable computations grouped in any desired manner by use of parentheses. Cells can also reference other cells by name. If cell D8 contained B5, then the value of D8 would be the same as the value of B5. If it contained @SUM(A1...A124), then the value of D8 would be the sum of the values contained in all the cells from A1 through A124.

The real advantage to an electronic spreadsheet program is the instant feedback for each calculation entered. Upon entering a formula, the spreadsheet is immediately

recalculated (assuming recalculation is turned on), and the value presented on the screen. This gives you a 'rough estimate' glance to see if the formula is at least in the ballpark. Normally, when writing a program to perform calculations, you don't get a chance to see the output of any particular formula until you run the whole program, or at the minimum, a compilable module.

## Basic Functions

In addition to the standard + - \* / < > and ^, most spreadsheet programs contain functions similar to the following:

@ABS	Return absolute value
@AND	Return <b>TRUE</b> if <i>all</i> <b>TRUE</b>
@AVERAGE	Calculate mean of list
@EXP	Raise <i>e</i> to a power
@FALSE	Return <b>FALSE</b>
@IF	Select value based on condition
@INT	Truncate value
@LN	Return natural log
@LOG	Return log base 10
@MAX	Return maximum value in list
@MIN	Return minimum value in list
@NOT	Return <b>TRUE</b> if <b>FALSE</b> else <b>FALSE</b>
@NPV	Calculate Net Present Value of list at discount rate
@OR	Return <b>TRUE</b> if <i>any</i> <b>TRUE</b>
@PI	Return value of Pi
@ROUND	Round a number to specified places
@SQRT	Return the square root
@SUM	Calculate the sum of a list
@TRUE	Return <b>TRUE</b>

Many of the newer spreadsheets also contain transcendental functions, standard deviation, internal rate of return and other specialized accounting functions.

@ACOS	Arc-cosine function
@ASIN	Arc-sine function
@ATAN	Arc-tangent function
@COS	Cosine function
@DIF	Calculate the difference of a list
@FRA	Return the fractional part of expression
@IRR	Return the internal rate of return
@PDIF	Return the percentage difference
@SIN	Sine function
@STDDEV	Return standard deviation of a list
@TAN	Tangent function

There are many different commands to operate on a worksheet, I will mention a few that should be considered when buying a spreadsheet software package. All have cursor movement from column to column, and row to row. Some allow movement to rows and columns by multiple movements. In addition to particular formats mentioned above, some work sheets allow "hidden" cells (the data is not displayed). You should be able to set the width of columns. The replicate command should have a "relative" copy, to copy cells with row and column orientation included. Most work sheets allow "windows", either horizontal or vertical screen splitting, with synchronous or unsynchronous scrolling. Some packages allow a "data save" to a textfile that can be operated on by a BASIC program, data base manager, mailing list or text processor.

### Who Can Benefit?

There are many uses for a spreadsheet package, ranging from storing data in lists to complicated accounting procedures. The main limitation on all home computers is the amount of available RAM to store the input information. In addition to the memory consumed by the program, most of the spreadsheet programs require that *all* of the data be in memory *all* of the time. Even with the efficiency of storing data in a compact format, it doesn't take a very great number of columns and rows to deplete a 64K machine. (One new program, *Multiplan*, implements a "virtual memory" system which allows spreadsheet data to be as large as available disk space by swapping into and out of memory, the sections of the data currently being used.) This explains all of the interest in additional RAM cards to increase the available RAM to 128K or more. Some spreadsheets allow up to 512K of additional memory.

Very specific applications that can be expected to remain unchanged, such as maintaining a checkbook, are probably handled more easily with a dedicated program. A spreadsheet is very useful for applications that change

often, being easily modifiable, and with instantaneous feedback as to the correctness of the calculations. Some applications, such as your income tax, change with each use. A spreadsheet set up to calculate your Form 1040 could be easily modified each year to account for changes in the form by the IRS. A dedicated program designed for a particular year would have to be rewritten each subsequent year.

Small database applications — for instance, lists of names, addresses and telephone numbers — can be easily maintained and sorted (only newer products have automatic sorting capability) by zip, last name, etc.

The ability to see and adjust the screen formatting is also very useful. Printed output for monthly finances, budgets and other reports is quickly generated and the templates can be used again each time a new report is needed.

Anyone connected with a statistically-oriented team (what sport isn't?) can keep records and all the associated stats easily and make updates quickly and effortlessly. Bowling league, Little League and local school teams can benefit from accurate reports generated on a timely basis.

### Some Samples of Use

Spreadsheets can be used for tracking expenditures against a proposed budget. Many companies have to allocate an advertising budget amongst several different media and products. It is a simple matter to design an overall budget plan and then juggle figures on the spreadsheet to develop a good mix between emphasized products and target audiences. Recalculation of the budget totals is swift and feedback of the effects of various strategies is essentially, instantaneous.

Bid preparation can be handled well on a spreadsheet. Since pinning down all the expenses is very difficult, and profit margin depends a great deal on the accuracy of the bidding, a tool for juggling the numbers facily is a great

Program	Manufacturer	City, State	ZIP	Computer
A Financial Wizard 1.5	ON LINE Computer Centers	10944 North May	Oklahoma City, OK	73120 Atari
Accountant	Decision Support Software	1438 Ironwood Drive	McLean, VA	22101 Apple
BusiCalc	Skyles Electric Works	2316 South Whisman Road	Mountain View, CA	94041 Pet/C64/Vic
Business Planner	Duosoft Corporation	1803 Woodfield Drive	Savoy, IL	61874 Apple
Business Planning Tool	Sofstar	13935 Highway J	Juno Beach, FL	33408 Apple
Calc Result	Computer Marketing Services	300 West Marlton Pike	Cherry Hill, NJ	08002 C-64
CalcStar	MicroPro International	33 San Pablo Avenue	San Rafael, CA	94903 Apple CP/M
Desktop PLAN	Visicorp	2095 Zanker Road	San Jose, CA	95134 Apple
DYNACALC	Computer Systems Center	13461 Olive Blvd.	Chesterfield, MO	63017 Flex
EliteCalc	Elite Software	Box 11224	Pittsburgh, PA	15238 TRS-80C
FCS-EPS	EPS	One Industrial Drive	Windham, NH	03087 Apple
Financial Analysis	Aeronca /Execuware	4530 Park Rd., Suite 348	Charlotte, NC	28209 Apple
Financial Modeling	Georgia Tech Research	225 North Avenue	Atlanta, GA	30332 Apple CP/M
Financial Planner	Ashton-Iate	10150 N. Jefferson Blvd.	Culver City, CA	90230 Apple CP/M
FORECAST	Northwest Analytical	1532 Southwest Morrison	Portland, OR	97205 Apple CP/M
LogiCalc	Software Products International	10343 Roselle Street	San Diego, CA	92121 Apple
MAGICALC	Artsci	5547 Satsuna Avenue	North Hollywood, CA	91601 Apple
microFINESSE	The P-E Consulting Group	Park House, Egham	Surrey, England	Apple
Micro-DSS/Finance	Ferox Microsystems	1701 N. Fort Meyer Dr.	Arlington, VA	22209 Apple
Multiplan	Microsoft Corporation	10700 Northrup Way	Sellvue, WA	98004 Apple/C64
Optimizer	Supersoft	P.O. Box 1628	Champaign, IL	61820 Apple
PeachCalc	Peachtree Software	3445 Peachtree Rd. NE	Atlanta, GA	30326 Apple CP/M
PLAN90	Digital Marketing Corporation	2363 Boulevard Circle	Walnut Creek, CA	94595 Apple CP/M
Senior Analyst II	Apple Computer Company	20525 Mariana Avenue	Cupertino, CA	95014 Apple
Spectaculator	Radio Shack	300 One Tandy Center	Fort Worth, TX	76102 TRS-80C
Super "Color" Calc	Nelson Software Systems	9072 Lyndale Avenue, So.	Minneapolis, MN	55420 TRS-80C
SuperCalc	Sorcim Corporation	2310 Lundy Avenue	San Jose, CA	95131 Apple CP/M
TABULA RASA	Computer Systems Consultants	1454 Latta Lane	Conyers, GA	30207 Flex
Visicalc	Visicorp	2095 Zanker Road	San Jose, CA	95134 Apple/Pet
VI-CALC	United Microware Industries	3503 E Temple Avenue	Pomona, CA	91768 Vic

help in maximizing profit. All of the various factors — consulting, labor, equipment, materials and subcontracting — can be charted, with considerable "what-ifing" being done with the figures to arrive at an appropriate idea of expenses. The expected margin of profit can be added with some assurance that the final figures have taken a good deal of the risks involved into consideration.

Many small accounting type problems can be easily solved without resorting to large, unwieldy, fixed-format accounting packages. This is especially true of smaller businessmen who might not want to spend a lot of money for special accounting software that would need to be tailored to their own particular business. A spreadsheet can do multiple checkbooks, prepare invoices and purchase orders, track accounts payable and receivable, and a multitude of other accounting functions. While none of the "just" spreadsheet programs can match a fully developed accounting system, some of the newer spreadsheets can do most, if not all, of the job.

At MICRO, we use a spreadsheet program for much of our work involving simple accounting procedures and data-base management. It keeps all of our paper work under control and we only have to enter names and addresses one time, with everyone sharing the files for additional uses. For instance, to help with the organization of the advertising department, we have a list of advertisers, such as figure 1, which can include such information, in addition to names and addresses, as account number, advertising pages, page size, page rate, commissions, and sales regions.

From such a master list, it is a simple matter to sort the list monthly by current page size, deleting the accounts that are currently inactive, alphabetizing the remaining accounts for a monthly advertising summary. The next step is to sort the list by region (figure 2) so that each sales representative can see the totals for his region and in comparison to the other regions. We can add magazine page numbers to the list (figure 3) and dump the list to a text file, instead of the printer, and transfer it to the typesetter to compose the advertisers' index without rekeying all the names. (See MICRO 59:54 for further details of our typesetting communications.)

A quick look at a work sheet to figure monthly income-expenses shows how simple a work sheet template can be, but still have a useful function. With a minimum of effort, each month, a quick summary can be prepared by entering the few necessary figures.

Figure 4 illustrates how formulae are stored in cells. The third column (C) contains the formula for the sum of cells Dn and En where n is the row number. This column is easily filled in by defining the formula in cell C5, and then, using the Replicate command with "relative" values, copying that cell into C6..C78. The formula in C80 is the sum of column C, and that is replicated into D and E. The screen display can show either the calculated values or the actual formulae. This is set from the command line.

This figure is a split example to demonstrate the relationship between formulae in the cells and the values in the cells. The chart was printed out once in formula dump mode and once regularly and then superimposed to give the illusion of the formulae being present with the values.

Record keeping for a team such as baseball or soccer is easily managed on a work sheet (figure 6). Such a list can

easily be sorted by last name for a team roster, by birthdate for eligibility and yearly updating, by phone numbers for a telephone tree, by zip code for a mailing list or by other factors such as individual game statistics or personal factors.

Other topics that lend themselves to worksheet solving include accounts receivable ageing, invoicing from inventory, cost recovery, production scheduling, estimating, checkbook ledger, engineering formulae, accounts payable, payroll reporting, monthly sales reporting, daily inventory and financial forecasting.

## Advanced Uses

There are additional features to be found on most spreadsheet packages. These are more complicated to use and require a deeper understanding of how a worksheet functions. These include, but are not limited to:

**@CHOOSE** Returns the value of a particular cell  
**@COL** Returns the current column number  
**@COUNT** Returns the number of cells in a range  
**@ERROR** Returns error message  
**@INDEX** Returns value next to match  
**@ISERROR** Returns TRUE if ERROR, otherwise FALSE  
**@ISNA** Returns TRUE if NA, otherwise FALSE  
**@LOOKUP** Returns value less than or equal to match  
**@NA** Returns NOT AVAILABLE error  
**@ROW** Returns the current row number

The @CHOOSE function is useful for selecting a value from a pre-determined list. It is similar to @LOOKUP, except that the table does not have to be defined in the worksheet proper. For instance, if you knew that in Trial 1 you wanted to use an interest rate of 11.5%, in Trial 2 you would use 13.5%, and in Trial 3 you would use 17.875%, by defining cell C4 to contain the particular number of the trial you are running, the following formula can be used anywhere in the sheet to substitute for the appropriate interest rate:

```
@CHOOSE(C4,.115,.135,.17875)
```

When cell C4 contains a 1, the value returned is .115, if it has a 2, then the value is .135, and if it has a 3, the value is .17875.

The @COL function is useful for indexing items that ascend by increments of one, such as dates. The value for column A is 1, B is 2 and so on. If you replicate a formula such as

```
1982 + @COL
```

across the top of the worksheet, you will quickly generate a yearly sequence.

The @ROW function is useful for indexing items that ascend by increments of one, such as counters. The value for row 1 is 1, 2 is 2 and so on. If you replicate a formula such as

```
@ROW-6
```

down the side of the worksheet starting in row 7, you will quickly generate a numbered list.

The @COUNT function is useful for determining n, the number of items used in calculating a particular formula. Such a determination is necessary in many statistical analyses, such as NPV or STDDEV. @COUNT includes only values in the specified range, it does not



1	A	11	B	12	C	13	D	14	E	15	F	16	G	17	
1	[ADV-M02]	Advertising Pages			Advertiser by Month										
2		Year													
3	Advertiser	A/C #	1983	065	M66	Contract								Reg	
4															
5	AB Computers	ZABCOM	2	1	1	3/84								B2	
6	Acorn Software Systems	ZACORN	5	25	25									M4	
7	Alternative Energy Products	ZALTER	1	5	5	6/84								M4	
8	Amplify	ZAMPLI	5	25	25	4/84								K3	
9	Apogee	ZAPOGE	33	33	33									M4	
10	Apple Tree Electronics	ZAPPLE	34	17	17	4/84								M4	
11	Arbutus Total Soft	ZARBUS	1	5	5	6/84								M4	
12	Ark Computers	ZARK	1	1	1	4/84								M4	
13	Artsci	ZASOFT	1	1	1									M4	
14	Atari Home Computers		1	1	1	10/84								B2	
15	Atari Program Exchange		1	1	1									M4	
16	Aurora Software	ZAUROR	17	17	17	6/84								K3	
17	Avalon Hill		1	1	1									B2	
18	Check-Mate	ZCHECK	2	1	1	12/84								M4	
19	Commander Magazine	ZCOMMA	25	25	25	6/84								M4	
20	Communications Electronics	ZCELEC	1	1	1									K3	
21	Computer		66	33	33	2/84								M4	
22	Computer		66	33	33										

Figure 1. A sample worksheet of advertisers

1	A	11	B	12	C	13	D	14	E	15	F	16	G	17
1	[ADV-M02]	Advertising Pages			Advertiser by Month									
2		Year												
3	Advertiser	A/C #	1983	065	M66	Contract								Reg
4														
5	Check-Mate	ZCHECK	2	1	1	12/84								M4
6	Computer Exposition	ZIC	66	66	66									B1
7	Computer Science Engineering	ZICSE	25	25	25									M4
8	Granite Computer Sales	ZGRANI	25	25	25									M4
9	Inter-Action	ZINTER	1	5	5	6/84								M4
10	Leading Edge	ZLEAD1	2	1	1									B1
11	Micro Spart	ZIN	2	1	1									B1
12	Microbits	ZIN	33	33	33									M4
13	Monarch Data Systems	ZMONAR	25	25	25	5/84								M4
14	Omega Sales International	ZOMEGA	1	1	1	12/84								M4
15	Performance Micro-Products	ZPERFO	5	25	25	5/84								M4
16	Pion Inc	ZPTON	1	5	5	3/84								M4
17	Richvale Telecommunications	ZRICHV	2	1	1									K1
18														
19	Avalon Hill	ZA	1	1	1									B2
20	AB Computers	ZABCOM	2	1	1	3/84								B2
21	Computer Mail Order	ZCMOIL	4	2	2	2/12/84								B2
22	Computer Marketing	ZCMKT6	2	1	1	3/84								M2
23	Computer Science	ZC	33	1	1									M2

Figure 2. Sample worksheet sorted by account region

1	A	11	B	12
1	[ADV-M02]	Page #		
2				
3	Advertiser			
4				
5	AB Computers	93		
6	Acorn Software Systems	18		
7	Alternative Energy Products	94		
8	Amplify	28		
9	Apogee	100		
10	Apple Tree Electronics	92		
11	Arbutus Total Soft	6		
12	Ark Computers	100		
13	Aurora Software	45		
14	Avalon Hill	57		
15	Check-Mate	18		
16	Commander Magazine	19		
17	Communications Electronics	23		
18	CompuTech	8		
19	Computer Exposition	70		
20	Computer Mail Order	84-85		
21	Computer Marketing	1		
22	Computer Science	54		
23	Computer Systems			

Figure 3. Sample worksheet with pages added for index

count labels or blanks. You can specify a list, range or list of ranges in the argument.

The @LOOKUP function is very useful to read elements of a table included in the worksheet. Suppose a software package had the following price based on quantity:

Quantity	Price/Package
100	22.95
300	17.95
500	14.95
800	11.95
000	9.95

This would be entered in the worksheet in two adjacent columns, say D and E. The price per document can be entered anywhere in the worksheet by the formula:

@LOOKUP(B2,D1..D5)

The @LOOKUP function would determine the quantity ordered from cell B2, say 650, and then skim through the D1..D5 column looking for a value larger than the current value. When it finds one, in this case at D4, it then backs up one entry and reads the value in the next adjacent column, here 14.95 (from E3), and returns with this value. It is also possible to specify the range to be searched as a row, and the value will be taken from the row below the searched row.

The @INDEX function is the same as the @LOOKUP function (cf.), except that an exact match is required.

The @ERROR function is used in several different ways. @ERROR displays the word "ERROR" in the current cell, and in any cells with formula references to that cell. It can be used in tables with CHOOSE, INDEX or LOOKUP formulae to screen out invalid table entries. It can also be used in combination with an @IF statement to exclude certain values from an acceptable range. For instance, if you wanted to sum a range of numbers only if A1 was in the range of 50-100, then the following formula could be used:

@IF(@AND(A1..=50,A1..=100),@SUM(B1..B20),@ERROR)

This would check the value of A1 before evaluating the formula and would return "ERROR" if the value was outside the specified range.

The @NA function is used for template generating. All of the cells which require entered data are first flagged with @NA. Later, after the data has been entered, a simple test can be used to check to see if all the cells have been updated.

The @ISERROR function tests any type of argument and returns TRUE if the argument is an ERROR condition, false if it is not an ERROR. This is a good way to test whether one or more calculations has produced an error:

@IF(@ISERROR(A3),0,A3\*B5)

The @ISNA function tests any type of argument and returns TRUE if the argument is a NOT AVAILABLE condition, false if it is available. This is a good way of making calculations conditional on the availability of data:

@IF(@ISNA(A3),@NA,A3\*B5)

Some fairly complicated worksheets can be developed using these advanced features.

## Memory Considerations

The particular spreadsheet that we use is a Flex-based

system called *Dynacalc*. Since that is the system that I am most familiar with, I will describe some of the working techniques of that system, assuming that all work-sheet programs must use an overall somewhat similar system, while perhaps differing on some of the fine points.

This program allows 256 columns and 256 rows, not both at once, as it would require 128K bytes just to address all of the cells. A cell table is set up with a two-byte address for each cell in use (sometimes not in use, as we shall see). The cell table can hold 7680 entries, which means that you can address to cell AD256, for a tall worksheet with many rows, or to cell IV30, for a long worksheet with many columns, or any combination in-between, as long as the total figure ROW\*COL doesn't exceed 7680.

Each entry in the cell table requires a two byte address. If you GOTO cell AD256 and enter a single character, you will have consumed 15360 bytes for cell addresses and one byte for the label. The program allocates all cells horizontally and vertically up to the largest address in use. However, it doesn't subtract cells from the table ever. If you have overflowed memory and deleted several rows, you won't get the full benefit of extra memory until you /S SAVE the file and /S LOAD the file back into the system after /Clearing the workspace. When the file is read back into memory, the unused rows and/or columns will not be allocated in the cell table with the resultant saving in memory.

Each value uses 10 bytes of memory, even "0". A cell reference in another cell also uses 10 bytes. Placing a B1 in cell A2 uses 10 bytes of memory. Labels use only one byte per character. Therefore, if you have a numerical sequence of labels "1", "2", "3" ..., it is much more memory efficient to enter them with a leading ' (single quote) to assure that the worksheet considers them to be a label.

A calculation (@SUM[A1...etc.]) starts at 10 bytes and consumes additional memory depending upon how long the calculation is. Therefore, if you are running out of room, it will save space to put an often used calculation in one cell, and reference it from other cells. If you are really desperate for a few extra bytes, replacing a formula by its value will also save space, at the expense of recalculation time, if any of the values in the formula change. You would have to re-enter the formula to recalculate the results (or do it by hand).

## Visual display

Stop me if you've heard this one before — you really need 80 columns to be able to see a reasonable portion of the worksheet. Some of the new video boards (for Apple anyway) allow a display of 132 columns on-screen. The more you can see, the easier and faster it is to work with the program. The less scrolling that you have to do, the better. I use the GOTO *cell* command a lot because it is much faster than scrolling row by row or column by column to the desired site. I often add 20 to the desired cell number so that the cell is located in the upper portion of the screen when I get there.

When in the formula dump mode (formulae displayed on the screen instead of values), the formula is only printed to the width of the column. Often, this is not wide enough to see the whole formula on the screen, or printer. To enable printing of the whole formula, it is necessary to widen the columns containing the formulae somewhat. This is only necessary for dumping the formulae to a



printer. I often put the printer into compressed mode, to get the greatest number of columns on the paper at once. With a 15 inch carriage, you can print about 230 characters across.

I don't know how I functioned B.S. (that's before spreadsheets). I would recommend just about anyone who

owns a computer to try out **MICROCalc** (elsewhere in this issue), and if you really need the power and memory of a full-size spreadsheet, buy one of the many software packages available. A list of the spreadsheets available for the computers we normally cover is listed at the end of this article. Happy calculating!

[ A ]	[ B ]	[ C ]	[ D ]	[ E ]	[ F ]
3-Dealer	A/C#	Totals	WNA	M/A	BOM
4-					
5-Abacus North	99501A	@SUM(D5...F5)	75+150	225 30	30 12+9 21
6-A.P.P.L.E.	98032A	@SUM(D6...F6)	360+314+314+157	1145 187+187+187+2995	3556 54+54+5 113
7-Brodart Stacey	17705A	@SUM(D7...F7)	1990+4990	6980 86+135	221 18 18
8-Clinton Computer	20735A	@SUM(D8...F8)	4809	4809 141	141 77 77
9-Computer Shoppe	70002A	@SUM(D9...F9)	94	94 87+23+54	164 46+65 111
10-Computer Store	74105A	@SUM(D10...F10)	63+157	220 35+144	179 122+65 187
11-Comp. Market HI	96813A	@SUM(D11...F11)	1286	1286 31+31+31+76	169 67+54+90 211
12-Data Bank Fremont	94536A	@SUM(D12...F12)	360+210	570 520	520 79+52+9 140
13-Data Base	46805A	@SUM(D13...F13)	94+94+38	226 16+31	47 56+98 154
14-Data Domain	60195A	@SUM(D14...F14)	345+69	414 49+65+98+123	335 56 56
15-Esd Labortory	JAP-01	@SUM(D15...F15)	188+100+94	382 432	432 29+87 116
16-Farnsworth Comp.	60505A	@SUM(D16...F16)	361	361 86+54+67+32	239 87 87
17-Integratd DP	CAN-02	@SUM(D17...F17)	144+144	288 235	235 234+76+123 433
18-Kroch's&Brentanos	60603D	@SUM(D18...F18)	157	157 72+72+79	223 76+78+98 252
19-Malibu Microcomp	90265A	@SUM(D19...F19)	144+58	202 144+187+100+125+115+300	15+65+90 170
20-Micro Chip	48084C	@SUM(D20...F20)	94+94+20	208 87+45+987	1119 21 21
21-Micro Computer	45459A	@SUM(D21...F21)	188+188+188+176	740 16+87	103 76+29+7 112
22-Micron Dist.	CAN-21	@SUM(D22...F22)	720	720 1180+100+100+100+240	72+32+80 184
23-Ogamp Tech.Books	90038A	@SUM(D23...F23)	207+157	364 87+87+87	261 28+35 63
24-Pandasoft	GER-04	@SUM(D24...F24)	198	188 500+374+624+624+624+2746	78+54 132
25-Software Masters	60204D	@SUM(D25...F25)	157	157 249+249+250+250+250	1248 25 25
26-Software Store	33612B	@SUM(D26...F26)	62+157+62+157	438 129+40	169 76+36 112
27-Telecom Library	10011B	@SUM(D27...F27)	235	235 (115.2+186.75+72)*3	1122 45+65 110
28-Timecore	02114A	@SUM(D28...F28)	188+188+188	564 113	113 34+24+98+485
29-World Wide Media	10016D	@SUM(D29...F29)	235	235 4066+10+20+150+6000+500	70+6+3+875+105
30-					
31-TOTALS	@SUM(C4...C30)	@SUM(D4...D30)	21208	@SUM(E4...E30)	26809 @SUM(F4...F30)

Figure 4. A sample worksheet with formula dump on. An overlay of some of the values is superimposed.

[ A ]	[ B ]	[ C ]	[ D ]	[ E ]	[ F ]
Last Name	First Name	Address	City	State	Zip
1-BELANGER	SUZANNE	123456789	NEW YORK	NY	10001
2-CHANDORNET	SUSAN	123456789	NEW YORK	NY	10001
3-DOYLE	STEVE	123456789	NEW YORK	NY	10001
4-EGAN	STEPHEN	123456789	NEW YORK	NY	10001
5-EGAN	SUVA	123456789	NEW YORK	NY	10001
6-EGAN	REY	123456789	NEW YORK	NY	10001
7-FORD	ROBERT	123456789	NEW YORK	NY	10001
8-GEOR	PAUL	123456789	NEW YORK	NY	10001
9-HOZZE	MICHAEL	123456789	NEW YORK	NY	10001
10-JOHNSON	MICHAEL	123456789	NEW YORK	NY	10001
11-KANE	MICHAEL	123456789	NEW YORK	NY	10001
12-LEWALC	MARY	123456789	NEW YORK	NY	10001
13-LEWELP	MARTIN	123456789	NEW YORK	NY	10001
14-LIST	LARRY	123456789	NEW YORK	NY	10001
15-MATHIS	KRYSTAN	123456789	NEW YORK	NY	10001
16-McCORMACK	KEVIN	123456789	NEW YORK	NY	10001
17-McCORMACK	KEN	123456789	NEW YORK	NY	10001
18-McGURE	KATE	123456789	NEW YORK	NY	10001
19-ROYLETT	KAREN	123456789	NEW YORK	NY	10001
20-SCHINDLER	JOHN	123456789	NEW YORK	NY	10001
21-SEIDEL	GRETCHER	123456789	NEW YORK	NY	10001
22-SEANTIAN	GARY	123456789	NEW YORK	NY	10001
23-SIRAGO	DOLores	123456789	NEW YORK	NY	10001
24-SOUCY	DEBRA	123456789	NEW YORK	NY	10001
25-SULLIVAN	DAVID	123456789	NEW YORK	NY	10001
26-TINE	BRIDGET	123456789	NEW YORK	NY	10001
27-VERFUS	RETH	123456789	NEW YORK	NY	10001
28-WALDRON	AMY	123456789	NEW YORK	NY	10001

Figure 5. A sample of database usage.

# SANYO MONITOR SALE!!



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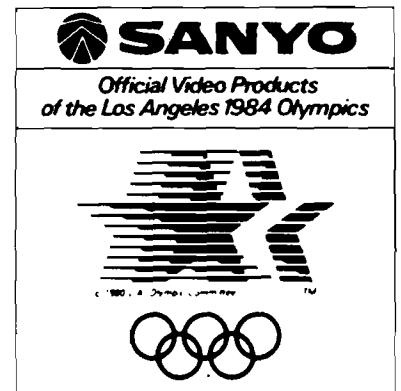
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14" Screen - Color Monitor (national brand)	<b>\$249.00</b>

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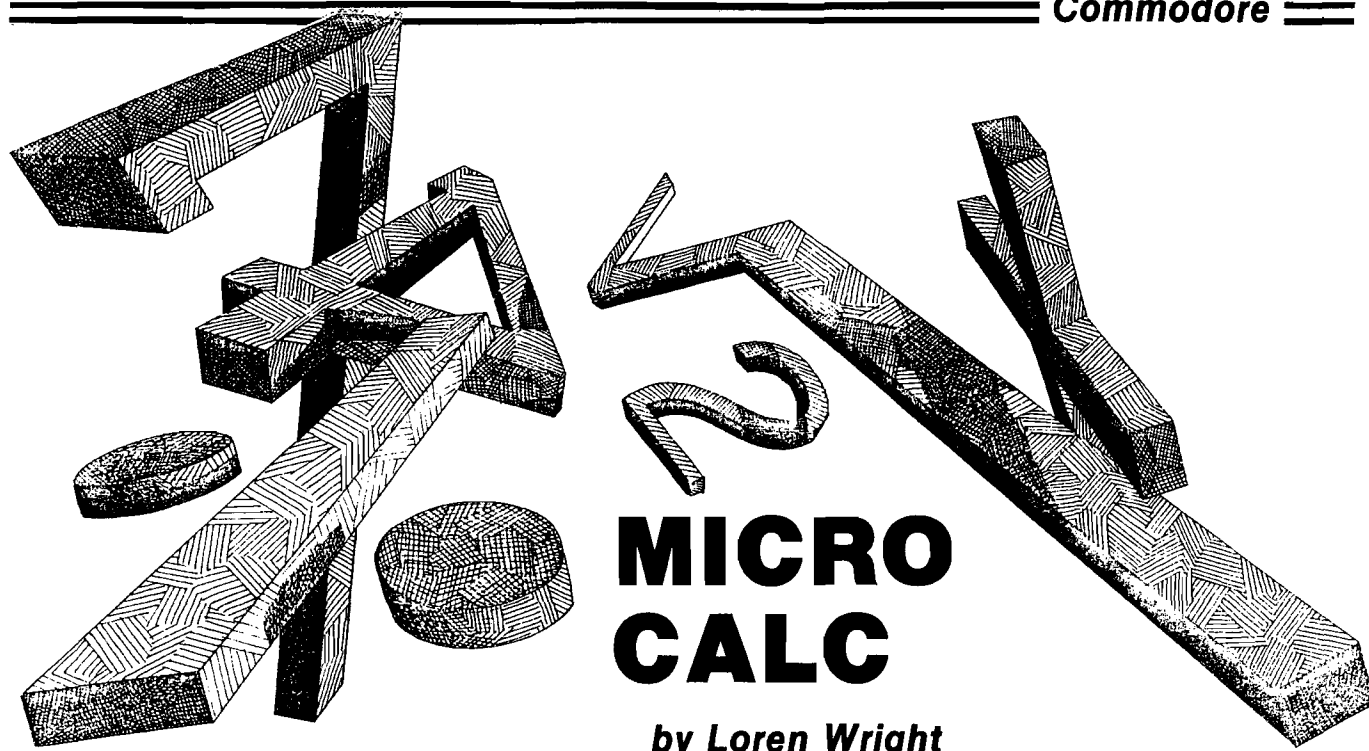


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# MICRO CALC

by Loren Wright

## Typing in the Listing

For all Commodore computers you will be typing in all or part of listing 1, the version for the Commodore 64. If you are using a PET or a VIC-20, you should skip the lines marked. There are different versions of these lines in listing 2 (for the VIC-20) and listing 3 for the PET. The features for the PET and Commodore 64 versions are the same:

- ✓ 20 working lines
- ✓ 20 corresponding comment fields
- ✓ support of disk or tape files
- ✓ optional zeroing of user variables
- ✓ multiple statement support
- ✓ display of disk file name

## The VIC-20 version has the following features

- ✓ 10 working lines
- ✓ support of tape files
- ✓ optional zeroing of user variables
- ✓ multiple statement support

## Operating Instructions

### Commodore 64

F7 performs calculation  
 F8 zeros user variables  
 left arrow enters file mode  
 British pound enters comment field

### VIC-20

The VIC-20 version operates the same as the Commodore 64 version, except there is no comment field, so the British pound key has no function.

See the comments in the main arti-

cle (page 11) for hints on how to get more onto the VIC's smaller screen. Predefined constants and functions will be particularly useful.

### PET

Since the PET has no function keys, these have been replaced:

@ performs calculation  
 { zeros user variables  
 left arrow enters file mode  
 backslash enters comment field

### Using the Internal Timer

Commodore computers have a special variable TI, which increments once every 1/60 second. You can use this timer on a Micro Calc screen to compare the speed of BASIC functions. Following is a screen that demonstrates how to do this:

```
A = 5.3507
T = TI
B = A ↑ 2
U = TI - T
U?
T = TI
B = A * A
U = TI - T
U?
```

You may be surprised by the results of this comparison between using exponentiation and simple multiplication to square a number. Other comparisons you may wish to try are:

using a number vs. a variable in a calculation

the SQR( ) function vs. raising to the .5 power  
 SIN( ) vs. COS( )

### How to Use the RND( ) Function

The RND( ) function on Commodore computers is actually a *pseudo*-random number generator. This is because each successive random number depends to some extent on the previous number. On VIC, C-64, and later PET models, the random number generator works as follows:

A *negative* argument reseeds the random number generator with a number calculated from the argument. If you use the same argument each time, you will generate the same sequence of random numbers. Use a negative argument only once to start a sequence. Then follow with positive arguments.

A *positive* argument will generate a new number in the sequence, without reseeding the generator.

A *zero* argument yields a random number that is not based on the seed.

To get the most closely random sequence, you should either use RND(0), or start by performing RND(-TI) and then follow with RND( ) using a positive argument.

To get random integers the following calculation should be used:

```
R = 10
N = INT[R * RND(0) + 1]
```

This gives random numbers N from 1 to R. If you leave the +1 out, you'll get numbers in the range 0 to R - 1.

## Comments on Commodore listings

Starting this month, our Commodore listings are being output on the EPSON FX-80 printer. This printer allows redefining some or all of the Epson ROM character set. After much testing, we arrived at a compromise set of characters. Since many of the reversed characters would be difficult to read at the size of these listings, we thought that it would be clearer for the reader typing these programs into his computer to underline the reversed characters. The Commodore programs that follow utilize this new style of listing. If anyone has any comments, pro or con, drop us a line with your viewpoint.

### Listing 1 Commodore 64

```

10 PRINT"█":POKE53281,0:POKE53280,0:
  GOSUB8000
20 Q$=CHR$(34):CR$=CHR$(13):
  DL$=CHR$(20):RB$="R_█"
25 BL$="-----":
  DI$="█+█":CC$="█"
30 NL=20:DIMC$(NL),S$(NL),S(NL)
40 LL=1:GOSUB8490:PRINT"SQ";:GOTO110
100 LL=1:GOSUB8500:PRINT"SQ";:
  GOSUB9000
110 S$=S$(LL):
  IFRIGHT$(S$,1)
  ="?"THENPRINT"R"BL$CR$:"TAB(10);
115 PRINTTAB(10)"█"S$DI$;
120 GOSUB2000
130 IFT$="█"THEN300
135 IFT$="█"THENGOSUB9000:LL=1:
  PRINT"SQ";:GOTO110
140 IFT$="█"THEN100
150 IFT$=CR$ORT$="Q"THEN210
160 IFT$=":"THEN270
170 IFT$=DL$THEN240
180 IFT$="_"THENS$(LL)=S$:GOSUB5000:
  GOSUB9000:LL=1:GOTO110
185 IFT$="ε"THENPRINT"R_█":S$(LL)=S$:
  GOTO1000
200 IFLEN(S$)<27THENS$=S$+T$:
  PRINTT$DI$;:GOTO120
210 S$(LL)=S$
220 LL=LL+1:IFLL=NL+1THENLL=1:
  PRINTRB$;:PRINT"SQ"TAB(10);:
  GOTO110
230 PRINTRB$CR$TAB(10);:GOTO110
240 IFS$=""THEN120
250 PRINTRB$"███"DI$;
260 S$=LEFT$(S$,LEN(S$)-1):GOTO120
270 S$(LL)=S$:LL=LL-1

```

```

275 IFLL=0THENLL=NL:
  PRINTRB$"S]]]]]]]]]]]
  QQQQQQQQQQQQQQQQQQQ";:GOTO110
280 PRINTRB$CR$:"TAB(10);:GOTO110
300 PRINTRB$:S$(LL)=S$:GOSUB3000:
  GOSUB7000:PRINT"SQ"TAB(10);:LL=1:
  GOTO110
1000 PRINT"SQ█";:LL=1
1010 C$=C$(LL):PRINTC$CC$;
1020 GOSUB4500
1030 IFT$="ε"THENPRINT"SQ";:
  C$(LL)=C$:LL=1:GOTO110
1040 IFT$=CR$ORT$="Q"THEN1100
1050 IFT$=":"THEN1200
1060 IFT$=DL$THEN1300
1065 IFASC(T$)<32ORASC(T$)
  >127THEN1020
1080 IFLEN(C$)<9THENC$=C$+T$:
  PRINTT$CC$;:GOTO1020
1100 C$(LL)=C$
1110 LL=LL+1:IFLL=NL+1THENLL=1:
  PRINT"_█SQ";:GOTO1010
1120 PRINT"_█"CR$;:GOTO1010
1200 C$(LL)=C$
1210 LL=LL-1:IFLL=0THENLL=NL:PRINT
  "_SQQQQQQQQQQQQQQQQQ";:
  GOTO1010
1220 PRINT"_█"CR$:"";:GOTO1010
1300 IFC$=""THEN1020
1310 PRINT"_███"CC$;
1320 C$=LEFT$(C$,LEN(C$)-1):GOTO1020
2000 GOSUB4500
2010 IFT$="█"ORT$=CR$ORT$="Q"ORT$=":"O
  RT$="OR
  T$=DL$ORT$="█"ORT$="ε"THENRETURN
2015 IFT$="█"THENRETURN
2020 IFT$>"ANDT$<:"THEN2070
2030 IFT$>:"ANDT$<["THEN2070
2040 IFT$>"ANDT$<,"THEN2070
2050 IFT$="^"THEN2070
2060 GOTO2000
2070 RETURN
3000 PRINT"S█CALCULATING"
3005 FORJJ=1TONL:
  IFRIGHT$(S$(JJ),1)
  ="?"THENGOSUB6500:GOTO3030
3010 IFLEN(S$(JJ))<3THEN3030
3020 A$=S$(JJ):GOSUB4000
3030 NEXT:PRINT"S_█":RETURN
4000 II=0:KK=II
4010 II=II+1:KK=KK+1:
  IFII>LEN(A$)THENGOSUB4100:RETURN
4020 XX=ASC(MID$(A$,II,1)):
  IFXX=59THENGOSUB4100:GOTO4010
4030 IFXX=33THENGOSUB4100:RETURN
4040 POKE511+KK,XX:GOTO4010
4100 POKE511+KK,0:KK=0:SYS828:RETURN
4500 GETT$:IFT$=""THEN4500
4510 RETURN
5000 PRINT"█RL█DAD OR RS█AVE"
5010 GOSUB4500
5020 IFT$="L"THENSA=0:FD$="S,R":

```

```

GOTO5045
5030 IFT$="S"THENSA=1:FD$=" ,S,W":
GOTO5045
5040 GOTO5010
5045 PRINT"QRD DISK OR RTAPE":
GOSUB4500
5046 IFNOT((T$="D")OR(T$="T"))
THEN5045
5048 INPUT"QQNAME";NA$
5050 IFT$="D"THENSA=SA+8:DV=8:NA$="@0:
"+NA$+FD$:OPEN15,8,15:GOTO5060
5055 DV=1:NA$=""
5060 OPEN1,DV,SA,NA$:
IFSAAND1THENGOSUB5090:GOSUB5200:
GOTO5080
5070 GOSUB5110:GOSUB5300
5080 CLOSE1:CLOSE15:GOSUB8000:
GOSUB8510:PRINT"SQ";:RETURN
5090 A$="":FORII=1TONL:S$=S$(II):
IFS$=""THENS$=" "
5100 A$=A$+S$+CR$:NEXT:PRINT#1,A$:
DE=0:GOSUB5900:RETURN
5110 FORII=1TONL:INPUT#1,A$:DE=0:
GOSUB5900:IFDETHENII=NL:NEXT:
RETURN
5115 IFA$=" "THENA$=""
5120 S$(II)=A$:NEXT:RETURN
5200 IFDETHENRETURN
5205 A$="":FORII=1TONL:S$=C$(II):
IFS$=""THENS$=" "
5210 A$=A$+S$+CR$:NEXT:PRINT#1,A$:
DE=0:GOSUB5900:RETURN
5300 IFDETHENRETURN
5310 FORII=1TONL:DE=0:INPUT#1,A$:
GOSUB5900:IFDETHENII=NL:NEXT:
GOTO5340
5320 IFA$=" "THENA$=""
5330 C$(II)=A$:NEXT
5340 RETURN
5900 IFDV=1THENRETURN
5910 INPUT#15,D1$,D2$,D3$,D4$:
IFVAL(D1$)=0THENRETURN
5920 PRINT" "D1$ "D2$ "D3$ "D4$
5930 FORJJ=1TO2000:NEXT
5940 DE=-1:RETURN
6500 BB=ASC(LEFT$(S$(JJ),1))-64:
IFBB>13THENBB=BB-13:GOTO6530
6510 ONBBGOSUB6560,6570,6580,6590,
6600,6610,6620,6630,6640,6650,
6660,6670,6680
6520 GOTO6540
6530 ONBBGOSUB6690,6700,6710,6720,
6730,6740,6750,6760,6770,6780,
6790,6800,6810
6540 S(JJ)=XX
6550 RETURN
6560 XX=A:RETURN
6570 XX=B:RETURN
6580 XX=C:RETURN
6590 XX=D:RETURN
6600 XX=E:RETURN
6610 XX=F:RETURN

```

I

```

6620 XX=G:RETURN
6630 XX=H:RETURN
6640 XX=I:RETURN
6650 XX=J:RETURN
6660 XX=K:RETURN
6670 XX=L:RETURN
6680 XX=M:RETURN
6690 XX=N:RETURN
6700 XX=O:RETURN
6710 XX=P:RETURN
6720 XX=Q:RETURN
6730 XX=R:RETURN
6740 XX=S:RETURN
6750 XX=T:RETURN
6760 XX=U:RETURN
6770 XX=V:RETURN
6780 XX=W:RETURN
6790 XX=X:RETURN
6800 XX=Y:RETURN
6810 XX=Z:RETURN
7000 PRINT"SQ";:FORII=1TONL:S$=S$(II):
SS=S(II)
7010 X$="":
IFRIGHT$(S$,1)="?"THENX$=STR$(SS)
+"R"+LEFT$(BL$,24-LEN(STR$(SS)))
7020 PRINTTAB(10)S$X$:NEXT:RETURN
8000 RESTORE:FORII=0TO42:READAA:
POKE828+II,AA:NEXT:RETURN
8490 FORII=1TONL:READS$(II):S(II)=0:
NEXT
8495 FORII=1TONL:READC$(II):NEXT:
GOTO8510
8500 FORII=1TONL:C$(II)=""S$(II)=""S(II)=0:NEXT
8510 PRINT" "C$";:FORII=1TONL:S$=S$(II):
C$=C$(II)
8520 PRINT" "C$LEFT$(BL$,10-LEN(C$))
" "S$ "R"LEFT$(BL$,28-LEN(S$))
8530 NEXT:
PRINT" "MID$(NA$,4) " "":
RETURN
9000 PRINT" "CLEAR"
9010 A=0:B=A:C=A:D=A:E=A:F=A:G=A:H=A:
I=A:J=A:K=A:L=A:M=A
9020 N=A:O=A:P=A:Q=A:R=A:S=A:T=A:U=A:
V=A:W=A:X=A:Y=A:Z=A
9030 PRINT" "S "S":RETURN
9828 DATA165,122,141,112,3,165,123,
141,113,3,169,0,133,122,169,2,
133,123,32,121
9848 DATA165,169,0,133,122,169,2,133,
123,32,165,169,173,112,3,133,122,
173,113,3
9868 DATA133,123,96
9900 DATAA=8000,M=48,I=11.9,I=I/1200,
D=(1-(1+I)^-M)/I
9910 DATAP=A/D,P=INT(P*100+.5)
/100,P?, ,
9915 DATA , , , , , , ,
9920 DATAPRINCIPAL,MONTHS,INTEREST, ,
DIVISOR, , , PAYMENT, ,
9925 DATA , , , , , , ,

```

J

K

L

M

## Comments on VIC and Pet listings

The C-64 listing is the complete MICROCalc listing. If you have a VIC, Expanded VIC or PET, then the listings are not complete. For VIC and PET, you must use the C-64 listing from lines 4000-7999; an Expanded VIC has additional changes to the standard VIC program.

### Listing 2 VIC-20

```

10 PRINT "C":POKE36879,8:GOSUB8000
20 CR$=CHR$(13):DL$=CHR$(20):
  RB$="R █":
  BL$="█":
  DI$="◆███"
30 NL=10:DIMS$(NL),S(NL)
40 LL=1:GOSUB8490:GOTO110
100 LL=1:GOSUB8500:GOSUB9000
110 S$=S$(LL):
  IFRIGHT$(S$,1)
  ="?"THENPRINT "R"BL$CR$";
115 PRINTS$DI$;
120 GOSUB2000
125 IFT$="█"THENPRINTRB$:GOSUB9000:
  LL=1:PRINT "SQ";:GOTO110
130 IFT$="█"THENPRINTRB$:S$(LL)=S$:
  GOSUB3000:GOSUB7000:PRINT "SQ";:
  LL=1:GOTO110
140 IFT$="█"THEN100
150 IFT$=CR$ORT$="Q"THEN210
160 IFT$=":"THEN270
170 IFT$=DL$THEN240
180 IFT$="_"THENS$(LL)=S$:GOSUB5000:
  GOSUB9000:LL=1:GOTO110
190 S$=S$+T$
200 IFLN(S$)<19THEN120
210 S$(LL)=S$
220 LL=LL+1:IFLL=NL+1THENLL=1:
  PRINTRB$"SQ";:GOTO110
230 PRINTRB$CR$CR$;:GOTO110
240 IFS$=" "THEN120
250 PRINTRB$"███"DI$;
260 S$=LEFT$(S$,LEN(S$)-1):GOTO120
270 S$(LL)=S$:LL=LL-1:IFLL=0THENLL=NL:
  PRINTRB$"SQSQSQSQSQSQSQSQSQSQSQSQ";:
  GOTO110
280 PRINTRB$CR$"XXX";:GOTO110
2000 GOSUB4500
2005 IFT$="█"THENRETURN
2010 IFT$="█"ORT$=CR$ORT$="Q"ORT$=":"O
  RT$="_"ORT$=DL$ORT$="█"THENRETURN
2020 IFT$>" "ANDT$<":THEN2070
2030 IFT$>:" "ANDT$<"█"THEN2070
2040 IFT$>:" "ANDT$<" "THEN2070
2050 IFT$="^"THEN2070
2060 GOTO2000
2070 PRINTT$DI$;:RETURN
3000 FORJJ=1TONL:

```

```

  IFRIGHT$(S$(JJ),1)
  ="?"THENGOSUB6500:GOTO3030
3010 IFLN(S$(JJ))<3THEN3030
3020 A$=S$(JJ):GOSUB4000
3030 NEXT:RETURN
-----
5100 XX=FRE(0):A$=A$+S$+CR$:NEXT:
  PRINT#1,A$:RETURN
-----
8000 RESTORE:FORII=0TO42:READA$:
  POKE828+II,AA:NEXT:RETURN
8490 FORII=1TONL:READS$(II):S(II)=0:
  NEXT:GOTO8510
8500 FORII=1TONL:S$(II)="":S(II)=0:
  NEXT
8510 PRINT "C";:FORII=1TONL:S$=S$(II)
8520 PRINT "█"S$R"LEFT$(BL$,
  20-LEN(S$)):NEXT:PRINT "SQ";:
  RETURN
9000 PRINT "S"█CLEAR█:A=0:B=A:C=A:D=A:
  E=A:F=A:G=A:H=A:I=A:J=A:K=A:L=A:
  M=A
9010 N=A:O=A:P=A:Q=A:R=A:S=A:T=A:U=A:
  V=A:W=A:X=A:Y=A:Z=A:
  PRINT "S":RETURN
9828 DATA165,122,141,112,3,165,123,
  141,113,3,169,0,133,122,169,2,
  133,123,32,121
9848 DATA197,169,0,133,122,169,2,133,
  123,32,165,201,173,112,3,133,122,
  173,113,3
9868 DATA133,123,96
9900 DATAA=8000,M=48,I=11.9,I=I/1200,
  D=(1-(1+I)^-M)/I
9910 DATAP=A/D,P=INT(P*100+.5)
  /100,P?,,

```

### Listing 3 Expanded VIC-20

Change These Lines to get the Improved Expanded VIC Version

```

130 IFT$="█"THENPRINTRB$:S$(LL)=S$:
  GOSUB3000:GOSUB7000:PRINT "SQ";:
  LL=1:GOTO110
135 IFT$="█"THENGOSUB9000:PRINT "SQ";:
  LL=1:GOTO110
180 IFT$="_"THENS$(LL)=S$:GOSUB5000:
  LL=1:GOTO110
230 PRINTRB$CR$;:GOTO110
280 PRINTRB$CR$"XXX";:GOTO110
2005 IFT$="@"THEN2005
2015 IFT$="█"THENRETURN
3000 PRINT "S"█CALCULATING":FORJJ=1TONL:
  IFRIGHT$(S$(JJ),1)="?"THEN
  GOSUB6500:GOTO3030
3030 NEXT:PRINT "S":RETURN
8510 PRINT "█Q";:FORII=1TONL:S$=S$(II)
8520 PRINT "█"S$R"LEFT$(BL$,
  20-LEN(S$)):NEXT
8530 PRINT "█"MID$(NA$,4)"███████"█S":
  RETURN
9920 DATA,,,,,,

```





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C-64

CIA

ALARM

CLOCK

8:30:58.9

By IAN ADAM

This article shows how to use the extremely accurate time-of-day clock built into the Commodore 64's CIA chip. The demonstration includes an alarm clock that runs independently of most other programs and I/O function.

The Commodore 64 does an acceptable job of keeping time with its TI\$ clock. All you have to do is set TI\$ to the current time, and it will run as long as the computer remains on. You can use the C-64 for just about anything else and just type ?TI\$ when you want the time.

However, there are several limitations on use of the built-in time function. First of all, it is not very convenient to use while a program is running. You have to STOP the program, carefully ask the time (no syntax error, or else...), then CONTINUE with the program. Second, the TI\$ function is not very accurate. A recent sample of a half dozen computers gave a typical error of 2.2%. That's over one minute per hour, or 32 minutes per day! Good enough to keep track of whether it's light or dark outside, perhaps, but not adequate to launch the space shuttle. The TI\$ clock also stops, running when a file or program is being loaded or saved. And third, of course, it's only there when you ask, and we all know how easy that is to forget!

But despair not; a ready solution is at hand. In fact, your 64 contains not one, but three clocks (count 'em!). The additional timepieces are contained in the two 6526 Complex Interface Adapter chips (CIA's), and they offer some considerable advantages. These two chips are provided by Commodore for the purpose of carrying out a multitude of housekeeping functions, such as generating interrupts, reading the keyboard and joysticks, external communications, etc. The two clocks are a bonus. And very accurate, too ...

they include tenths of seconds, and appear to be that accurate over the course of a day. They also keep running during input/output operations, in fact anytime the computer is turned on. With two clocks, you could keep track of the time in Mandalay, if you want, and there are even programmable alarms so you won't miss dinner there either!

### Using the Program

Type in the listing as shown; type the DATA statements carefully, since they contain the machine language program. Any error in that portion can crash the computer.

When you've finished typing, SAVE a copy of the program before you run it. This will avoid having to retype the whole thing in the event of a fatal typographical error. Then go ahead and RUN it. First, the program will READ the machine language DATA and store it in memory. The variable CH is a checksum to guard against errors in the data. If the program stops and indicates a data error, then double-check everything. Assuming that is ok, the program will then ask you to enter the correct time. Give the AM/PM and the hour; when asked for the minute, check an accurate time source, and type in the number of the next minute (e.g. if it's 8:30, type in 31), then wait until that minute arrives to press "RETURN". Pressing return starts the clock.

After the instructions, you will be prompted for the time you want the alarm to be set to. When the alarm time

matches the clock time, it will be announced by:

- the border of the screen flashing;
- a buzzing sound; and,
- the word "ALARM" flashing above the time.

If that isn't enough to attract your attention, then perhaps you're in a time warp! In any event, you can turn off this display simply by pressing the "F1" key.

When properly loaded, the program will run just like clockwork. It will supply you with the instructions, but for your reference I'll repeat them here:

- SYS 832: (equals) 0 to 15; recall time display to screen;
- SYS 994: turn off time display (still runs internally);
- POKE 982,n: change color, where n (equals) 0 to 15;
- GOSUB 9140: set or reset alarm time;
- F1: stop alarm display.

As before, the operating part of the program is in subroutine form, so you can include it in other programs as you wish. The commands listed above can also be used within a program, once the time is correctly set. To stop the alarm display under program control, just use POKE 197,4.

If the F1 key is not convenient for stopping the alarm, for example if your program uses it for some other purpose, then it can be changed: it's the value that appears in memory location 197

when the key is pressed.

The main program is stored in the cassette buffer, while the alarm portion occupies an unused area of page 2 memory as well. Thus, they may conflict with other programs that use these areas for machine language or sprites. The program would also be destroyed by any tape load or save activities. If these cautions create a problem, then the routine should be relocated to a different area of memory. This is a straightforward task, but does require a basic knowledge of machine language. For those who want to study the machine code, an assembly listing is provided [listing 2].

## Technical Details

The CIA clocks are a little more difficult to access than TI\$; with this program, however, it's as easy as apple pie. The time is contained in four registers for hours, minutes, seconds, and tenths [locations 56331 to 56328 for chip A, and 56587 to 56584 for chip B]. To avoid having the time flip over while reading the clock, all four registers are frozen whenever the hours register is read or written to. The clocks continue to keep good time while this is in progress. The last step in any access should be a read or write to the tenths-of-seconds register, to "unfreeze" the clock.

Each register stores its data in binary-coded decimal, or BCD, format. The hours register also contains an AM/PM indicator in bit 7. This would be an ideal format if the chip were running a display such as a digital alarm clock directly. For use in the computer, however, it does require some coding and decoding. This is a little awkward but not too difficult in BASIC, and even simpler in machine language. Once set, the clocks will automatically keep track of the time and AM/PM for as long as the machine is on, or until they are reset.

So how do we set the alarm? By exactly the same process as setting the time... by poking values into the same four registers! Only difference is, we first have to set bit 7 of the control register to a one. This signals to the chip that we want to set the alarm time instead of the clock time. The multiple use of these registers does keep things simple-honest! Lines 9160 and 9170 of the program take care of the BCD conversion. Line 9175 sets the control register to its normal value.

Once the alarm has been set, it cannot be read. When the prescribed time is reached, this is signalled by setting bit 2 of the interrupt register. The program must recognize this, and proceed

to alarm the operator in whatever way is specified. Don't worry, it won't bite. All of this may sound complicated, but the program takes care of the details.

These are the main registers involved:

Function	Chip A	Chip B
Hours & AM/PM	56331 (\$DC0B)	56587 (\$DD0B)
Minutes	56330 (\$DC0A)	56586 (\$DD0A)
Seconds	56329 (\$DC09)	56585 (\$DD09)
Tenths	56328 (\$DC08)	56584 (\$DD08)
Interrupt	56333 (\$DC0D)	56589 (\$DD0D)
Alarm Control	56336 (\$DC0F)	56591 (\$DD0F)

## A Quirk In The Chip

Help; there's a quirk on the loose! In programming the alarm, I came upon a most unusual feature. I got the alarm all set up, and (after a lot of hit-and-miss changes) finally got it to work well. Eureka. The only trouble was, the alarm would mysteriously sound for a second time, exactly one minute later. Really had me stumped for a while. After a sleepless night, however, it came to me what the problem was. Say the alarm is set for 8:30:00.0, and sounds at that time. One minute later, at precisely 8:30:59.9, the tenths-of-a-second register rolls over, giving an instantaneous time reading of 8:31:00.0, but it is apparently sufficient to trigger

a second alarm (sometimes).

There are three or four ways to program around this quirk, once you know it exists. I decided the easiest way to solve the problem would be to POKE a 1 into the tenths register [i.e. setting the alarm time in our example to 8:30:00.1]. This removes the alarm from the vicinity of the rollover, and seems to have banished the quirk to another world. If it should ever return to haunt you, please let me know; maybe we'll try an exorcist. **MICRO**

You may contact Ian Adam at 3706 West 20th Ave., Vancouver BC, V6S1E8 Canada.

## Listing 1

```

0 REM ** TIME IS OF THE ESSENCE **
1 REM
2 REM ** CLOCK DISPLAY WITH ALARM **
3 REM   FOR COMMODORE 64
4 REM
5 REM   BY IAN ADAM
6 REM   VANCOUVER, B. C.
7 REM
10 GOSUB9000
20 PRINT"CLOCK** TIME WAITS FOR NO MAN
   **Q
30 PRINT"CLOCK INSTRUCTIONS:Q"
40 PRINT"SYS 832:   TURN ON DISPLAY
50 PRINT"SYS 994:   TURN OFF DISPLAY
60 PRINT"POKE 982,N: CHANGE COLOUR
70 PRINT"GOSUB 9140: RESET ALARM
80 PRINT"F1:       TURN OFF ALARM
90 GOSUB9140:END:
   REM SET OR RESET ALARM
8990 REM BALANCE OF PROGRAM IS
   SUBROUTINES THAT CAN BE USED
   INDEPENDENTLY
9000 CH=0:FORI=832TO1008
9010 READA:POKEI,A:CH=CH+A:NEXT

```

(continued)



# Commodore

## Listing 1 (continued)

```

9015 FORI=679T0744:READA:POKEI,A:
      CH=CH+A:NEXT
9020 IFCH-23614THENPRINT"QWHO...DATA
      ERROR":STOP:NOTE CHECKSUM
9030 INPUT"QOQOQO IS IT AM OR PM";A$:
      INPUT"Q AND THE HOUR";H
9040 PRINT"QO ENTER THE MINUTE WHEN
      YOU WISH TO START
9050 PRINT" PRESS 'RETURN' TO START
      THE CLOCK:Q
9060 IFH>12THENA$="P":H=H-12:GOTO9060
9070 IFH>9THENH=H+6
      REM CONVERSION TO BCD
9080 IFLEFT$(A$,1)="P"THENH=H+128
9090 C=56328:POKEC+3,H:POKEC+1,0
9100 INPUTM:M=M+INT(M/10)*6
9110 POKEC+2,M:POKEC,0:SYS832:
      PRINT"QO IF NOT OK,
      PRESS ANY KEY
9120 FORI=1T01000:
      IFPEEK(198)THENPOKE198,0:SYS994:
      GOTO9030
9130 NEXT:RETURN
9140 PRINT"QWHAT TIME WOULD YOU LIKE
      THE ALARM?Q"
9145 INPUT"AM OR PM";A$:
      A$=LEFT$(A$,1)
9150 INPUT"THE HOUR";H
9155 IFH>12THENA$="P":H=H-12:GOTO9155
9160 H=H-6*(H>9)-128*(A$="P"):
      REM CONVERT TO BCD AND ADD AM/PM
      INDICATOR
9165 INPUT"THE MINUTE";M
9170 M=M+INT(M/10)*6
9175 C=56328:POKEC+7,136:POKEC+3,H:
      POKEC+2,M:POKEC,1:POKEC+7,8:
      REM ALARM
9180 POKE54273,99:POKE54278,240:
      POKE54276,21
9185 POKE54287,2:POKE54290,17:
      REM SOUND
9190 RETURN
9200 DATA 120,173,20,3,162,89,234,234,
      234,142,20,3,173,21,3
9210 DATA 162,3,234,234,234,142,21,3,
      88,96,173,11,220,170,41
9220 DATA 15,24,105,48,141,67,4,138,
      16,4,162,16,16,2,162,1,142
9230 DATA 77,4,162,32,41,16,240,2,162,
      49,142,66,4,173,10,220
9240 DATA 170,41,15,105,48,141,70,4,
      138,74,74,74,74,24,105,48
9250 DATA 141,69,4,173,9,220,170,41,
      15,105,48,141,73,4,138,74
9260 DATA 74,74,74,24,105,48,141,72,4,
      173,8,220,105,48,141,75
9270 DATA 4,169,32,141,65,4,141,76,4,
      141,79,4,162,14,157,24
9280 DATA 4,202,208,250,169,58,141,68,
      4,141,71,4,169,46,141,74
9290 DATA 4,169,13,141,78,4,169,1,162,
      13,157,65,216,202,208,250,76,167,
      2
9300 DATA 120,169,49,234,141,20,3,169,
      234,234,141,21,3,88,96
9310 DATA 173,13,220,41,4,240,3,141,
      227,2,173,227,2,240,42,173,162,0
9320 DATA 106,106,106,41,12,141,32,
      208,41,4,141,24,212,240,11,162,5,
      189
9330 DATA 227,2,157,33,4,202,208,247,
      173,197,0,201,4,208,6,142,227,2
9340 DATA 142,24,212,76,49,234,0,1,12,
      1,18,13

```

## Listing 2

```

0010 ; CIA ALARM CLOCK
0020 ; BY IAN ADAM
0030 ;
0035 ALARM .DE $02A7
0040 CINV .DE $0314
;HARDWARE INTERRUPT
0050 MESSGE .DE $0418
; 'ALARM' DISPLAYED HERE
0055 SCRMSG .DE MESSGE+9
0060 DISP .DE $0441
;BEGINNING OF TIME DISPLAY
0065 BORDER .DE $D020
0070 SIDVOL .DE $D418
0080 DSPCLR .DE $D841
;COLOR MEMORY
0090 ;CIA #1 REGISTERS
; FOR TIME DISPLAY
0100 TENTHS .DE $DC08
0110 SECS .DE TENTHS+1
0115 MINS .DE TENTHS+2
0120 HOURS .DE TENTHS+3
0125 CIAINT .DE TENTHS+5
;CIA INTERRUPT
0130 ALCTRL .DE TENTHS+7
0135 INTPTR .DE $EA31
;NORMAL CONTENTS
0140 ;
0150 ; .BA $0340
0160 ;
0340-78 0170 ;
0341-AD 14 03 0180 LDA CINV
0344-A2 59 0190 LDX #L,START
0346-EA 0200 NOP
0347-EA 0210 NOP
0348-EA 0220 NOP
0349-8E 14 03 0230 STX CINV
034C-AD 15 03 0240 LDA CINV+1
034F-A2 03 0250 LDX #H,START
0351-EA 0260 NOP
0352-EA 0270 NOP
0353-EA 0280 NOP
0354-8E 15 03 0290 STX CINV+1
0357-58 0300 CLI
0358-60 0310 RTS
0320 ;
0359-AD 0B DC 0330 ;START LDA HOURS
035C-AA 0340 TAX
035D-29 0F 0350 AND #$0F
035F-18 0360 CLC
0360-69 30 0370 ADC #$30
0362-8D 43 04 0380 STA DISP+2
0365-8A 0390 TXA
0366-10 04 0400 BPL LBLA
0368-A2 10 0410 LDX #$10
036A-10 02 0420 BPL LBLB
036C-A2 01 0430 LBLA LDX #$01
036E-8E 4D 04 0440 LBLB STX DISP+12
0371-A2 20 0450 LDX #$20
0373-29 10 0460 AND #$10
0375-F0 02 0470 BEQ LBLC
0377-A2 31 0480 LDX #$31
0379-8E 42 04 0490 LBLC STX DISP+1
037C-AD 0A DC 0500 LDA MINS
037F-AA 0510 TAX
0380-29 0F 0520 AND #$0F
0382-69 30 0530 ADC #$30
0384-8D 46 04 0540 STA DISP+5
0387-8A 0550 TXA
0388-4A 0560 LSR A
0389-4A 0570 LSR A
038A-4A 0580 LSR A
038B-4A 0590 LSR A
038C-18 0600 CLC
038D-69 30 0610 ADC #$30
038F-8D 45 04 0620 STA DISP+4
0392-AD 09 DC 0630 LDA SECS
0395-AA 0640 TAX
0396-29 0F 0650 AND #$0F
0398-69 30 0660 ADC #$30

```

(Continued on next page)

Commodore 64  
and  
VIC-20

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## Commodore

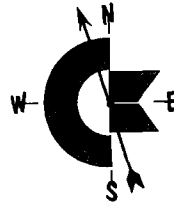
Listing 2 (continued)

039A-8D	49 04	0670	STA DISP+8
039D-8A		0680	TXA
039E-4A		0690	LSR A
039F-4A		0700	LSR A
03A0-4A		0710	LSR A
03A1-4A		0720	LSR A
03A2-1B		0730	CLC
03A3-69	30	0740	ADC ##30
03A5-8D	48 04	0750	STA DISP+7
03A8-AD	08 DC	0760	LDA TENTHS
03AB-69	30	0770	ADC ##30
03AD-8D	4B 04	0780	STA DISP+10
03B0-A9	20	0790	LDA ##20
03B2-8D	41 04	0800	STA DISP
03B5-8D	4C 04	0810	STA DISP+11
03B8-8D	4F 04	0820	STA DISP+14
03BB-A2	0E	0830	LDX ##0E
03BD-9D	1B 04	0840	STA MESSGE, X
03C0-CA		0850	DEX
03C1-D0	FA	0860	BNE LBLD
03C3-A9	3A	0870	LDA ##3A
03C5-8D	44 04	0880	STA DISP+3
03C8-8D	47 04	0890	STA DISP+6
03CB-A9	2E	0900	LDA ##2E
03CD-8D	4A 04	0910	STA DISP+9
03D0-A9	0D	0920	LDA ##0D
03D2-8D	4E 04	0930	STA DISP+13
03D5-A9	01	0940	LDA ##01
03D7-A2	0D	0950	LDX ##0D
03D9-9D	41 DB	0960	STA DSPCLR, X
03DC-CA		0970	DEX
03DD-D0	FA	0980	BNE LBLE
03DF-4C	A7 02	0990	JMP ALARM
03E2-7B		1000	SEI
03E3-A9	31	1010	LDA #L,INTPTR
03E5-EA		1020	NOP
03E6-8D	14 03	1030	STA CINV
03E9-A9	EA	1040	LDA #H,INTPTR
03EB-EA		1050	NOP
03EC-8D	15 03	1060	STA CINV+1
03EF-5B		1070	CLI
03F0-60		1080	RTS
		1090	
		1100	; UNUSED P. 2 AREA
		1110	
		1120	
		1130	.BA \$02A7
02A7-AD	0D DC	1140	LDA CIAINT
02AA-29	04	1150	AND ##04
02AC-F0	03	1160	BEQ BEGIN
02AE-8D	E3 02	1170	STA FLAG
02B1-AD	E3 02	1180	LDA FLAG
02B4-F0	2A	1190	BEQ RETURN
02B6-AD	A2 00	1200	LDA \$00A2
02B9-6A		1210	ROR A
02BA-6A		1220	ROR A
02BB-6A		1230	ROR A
02BC-29	0C	1240	AND ##0C
02BE-8D	20 D0	1250	STA BORDER
02C1-29	04	1260	AND ##04
02C3-8D	1B D4	1270	STA SIDVOL
02C6-F0	0B	1280	BEQ LBL
02C8-A2	05	1290	LDX ##05
02CA-BD	E3 02	1300	LDA FLAG, X
02CD-9D	21 04	1310	STA SCRMSG, X
02D0-CA		1320	DEX
02D1-D0	F7	1330	BNE LOOP
02D3-AD	C5 00	1340	LDA \$00C5
02D6-C9	04	1350	CMP ##04
02D8-D0	06	1360	BNE RETURN
02DA-8E	E3 02	1370	STX FLAG
02DD-8E	1B D4	1380	STX SIDVOL
02E0-4C	31 EA	1390	JMP INTPTR
02E3-00		1400	.BY0
02E4-41	4C 41	1410	.BY 'ALARM'
02E7-52	4D	1420	.EN

# MICRO™

## Commodore Compass

by Loren Wright



together in various ways. The heart of the package is the Chart of Accounts, which operates with the Checkbook Maintenance, Financial Statements, and Budget Analysis programs. Setting up is a little involved, but extra time spent in set-up is rewarded in time saved in maintaining your records. The first order of business is to set up your chart of accounts. There is a standard chart provided, but you will surely want to make changes, additions, and deletions. Accounts in the chart are divided into assets, income, liabilities, equity, and expense accounts. There is room for 99 different accounts, with up to 9 subcategories in each, up to a total of 300 subcategories. Next, you go through your checkbook, check by check and deposit by deposit. As you enter each item, you decide what account to credit or debit. Each check and deposit is automatically entered on the disk file. When you're done, not only have you balanced your checkbook, but you have also recorded your expenditures in the different accounts. There is provision for more than one checking account, although these files must be stored on separate disks, and you may indicate some payments to take place automatically. There is a great deal of support for error checking and for making backup copies of your disks.

When you have your checkbook balanced, you can then proceed to generating financial statements or to budget analysis. Other capabilities of these programs include generating checks from your computer, graphing results in color on the screen or on a VIC printer, and checkbook search. The other programs, which don't work with the ones mentioned above, include a Payments Calendar, Appointments Calendar, and Mailing List.

I had a little trouble figuring out when a debit subtracts from and when it adds to an account. An appendix in the excellent manual explains these terms — I wish I had read it before I started entering checks! *Complete Personal Accountant* is available from Programmer's Institute for \$79.95. The cassette version is \$74.95, and the package has been divided into three parts for about \$30 each.

### Getting Started in Machine Language

There are several things you can do with your VIC or C-64 in machine

### Low-cost Word Processing for C-64

Commodore has been bringing out a great deal of software for the Commodore 64 lately. Most of it is very good and most of it is priced less than competing products. *Easy Script* is no exception.

It is very much like Steve Punter's *Word Pro 3 Plus/64* (sold by Professional Software and Pro-Line and reviewed earlier in this column). In fact, the overall design and command syntax are nearly identical. There are several differences, and most of them work in favor of *Easy Script*.

Like *Word Pro 3 Plus/64* (which I hereafter refer to as simply *Word Pro*), *Easy Script* uses a wordstream format, which results in words being split across the end of a screen line. Screens of the two word processors look very similar. *Easy Script's* is a bit easier to follow because the cursor flashes and because line endings and format characters appear in reverse field. *Easy Script* allows you to set a working screen width of up to 80 characters. This makes working with tabular and indented material much easier, but typing on this wider screen is not very convenient due to the necessary panning across the 40-column screen. There is also an output-to-video function (lacking in the C-64 version of *Word Pro*), which allows you to see what your document looks like before you print it out. While viewing the video output you can select any page or pages for printing out. With *Word Pro* you get all or nothing.

*Easy Script* can be used with either cassette or disk, but not both at the same time. Editing is more convenient, particularly since there are true block-delete, -transfer, and -copy commands. *Word Pro* only allows these operations on whole screen lines. There is also a major difference in the files produced by the two word processors. *Word Pro* produces *program* files, while *Easy Script* produces *sequential* files. Sequential files are more accessible

from other programs, including your own BASIC programs. *Easy Script* allows considerably more text in memory at one time — 764 lines vs. 329. It is also possible to save only part of the text in memory to a disk file.

*Easy Script* lacks the "extra text" feature of *Word Pro*, but at least one use of it is taken care of: *Easy Script* makes it possible to get a disk directory without wiping out text in memory. Another use of extra text is not duplicated. *Easy Script* has no "append characters" or "append text" features. With *Word Pro* it is possible to label a number of frequently used phrases or text segments in extra text and call them into main text with a few keystrokes.

*Word Pro* was once the best word processor available for Commodore machines. It can no longer claim that honor. As each new Commodore machine has come out, a new version of *Word Pro* has become available, but instead of taking advantage of the features of the machine, only enough changes to get it running have been made. *Easy Script* is a better word processor, and, according to Jim Strasma and a number of others, *Paper Clip* from Batteries Included is also better. *Easy Script* is especially attractive because of its price. Commodore won't quote a suggested retail price, but \$50 is a good guess.

### The Complete Personal Accountant

Since I am now completely self-employed, I suddenly need to keep much better financial records. I was intrigued by Jim Strasma's number one rating for *Complete Personal Accountant* in last month's Commodore Buyer's Guide, so I obtained a copy with the idea of reviewing it here. I now have a good start on getting my finances in order!

Formerly called *The Color Accountant*, *Complete Personal Accountant* is actually a set of programs that work

## Commodore

language that you can't do in BASIC, and there are many things that can be done faster. For instance, using BASIC to clear the high resolution screen is a very slow process that takes a fraction of a second in machine language, and raster interrupt programming is virtually impossible in BASIC. As the computer comes, though, there is little that you can do beyond simple programs that you POKE in from DATA statements. Larger and more expensive computers have built-in machine language monitors, while less expensive, smaller computers, including Atari, Color Computer, VIC, and Commodore 64 do not. A monitor is a program that lets you look at and modify the contents of memory locations and processor registers, and load and save ranges of memory. An *extended* monitor is one that adds extra functions, such as a disassembler, a mini-assembler, and trace and break-point capability. Monitors are available on cartridge, disk, or cassette. Some of the better known monitors for Commodore machines are VICMON, 64MON, HESMON, SUPERMON, MICROMON, and TINYMON. There is also a

minimal monitor included with Richvale Telecommunication's V-Link and 64-Link cartridges. VICMON and 64MON are cartridges available from Commodore; HESMON is available on cartridge for both machines from Human Engineered Software; and the others are disk or cassette-based monitors available as listings in magazines or from user's groups. One of the commercial cartridges will cost \$40-\$50. The others are free or nearly free.

You should also have a copy of the *Programmer's Reference Guide* for your computer and a good general 6502 programming book, such as Lance Laven-thal's *6502 Assembly Language Programming*.

The next step is to get a full-fledged assembler. This will cost about \$100. I have been using PAL (by Brad Templeton, sold by Pro-Line Software) and find it especially convenient because it's designed to work with POWER, which I reviewed here earlier. PAL does not have macros or conditional assembly, but it has several advantages, such as using the BASIC editor for source files. It is quite a bit

smaller than others and is relatively position-independent. MAE, from Eastern House Software, is a full-featured assembler that is well supported. It is still the only assembler available for all the major 6502 machines. I have used versions for the PET since the beginning. Commodore's assembler is also an excellent package that includes macros and conditional assembly. There are other programs beyond the assembler, such as Pterodactyl's *PTD 6502/6510 Debugger*, but they are for pretty serious programming.

If you are at all serious about learning about computers, you owe it to yourself to explore machine language. Many things will suddenly become much clearer. You may not end up doing a lot of assembly language programming, but just the exercise will be rewarding.

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You may contact Loren Wright  
at P.O. Box 6502  
Amherst, NH 03031.

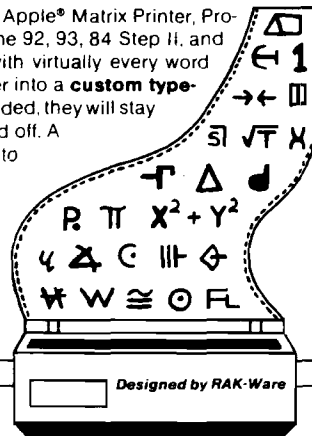
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**MICRO**™**Commodore Reviews**

Product Name: **SYSRES**  
 Equip. req'd: Commodore 64 and 1541 disk drive  
 Price: \$95.00  
 Manufacturer: Solidus International Corp.  
 1060 Roosevelt Crescent  
 North Vancouver, BC  
 Canada, V7P 1M3  
 (604)984-0477

**Description:** *Sysres* is supplied on a single 5 1/4" disk. It extends and enhances the C-64 operating system. Originally developed for the PET, *Sysres* adds 33 new commands to BASIC and includes 11 DIS-support commands. The added commands provide such features as renumbering a program, search and replace, auto-line numbering, forward and backward scrolling through a listing, and many more. Some of these new commands function in different ways, depending upon the options selected, so that altogether over one thousand new functions are added. *Sysres* will function with an IEEE-488 adaptor, gaining access to larger, faster CBM dual disk drives and printers. It also supports non-CBM, ASCII printers.

**Pluses:** Although the number of features available is large, the syntax is clear and logical — quite easily mastered. Also notable is the fact that *Sysres* code is "hidden" — using almost none of the available program space. It can be booted without disturbing the resident BASIC program. From end-to-end *Sysres* appears to be well thought out and professionally implemented. In the "programmers aid" category *Sysres* is definitely a Cadillac. Note that programs written using *Sysres* do not need *Sysres* to run later.

**Minuses:** The system is supplied on a Master diskette that is copy protected. It cannot be backed up. However, Solidus guarantees replacement free of charge within 90 days of purchase, and replacement for \$10.00 thereafter.

**Skill level required:** This product is targeted for the serious programmer. However, its logical, easily learned syntax should make it useful for anyone with even modest proficiency in BASIC.

**Documentation:** The *Sysres* master disk is accompanied by a 112 page user's guide in the form of a 3-ring hard-

(Continued on next page)

## What's Where in the Apple

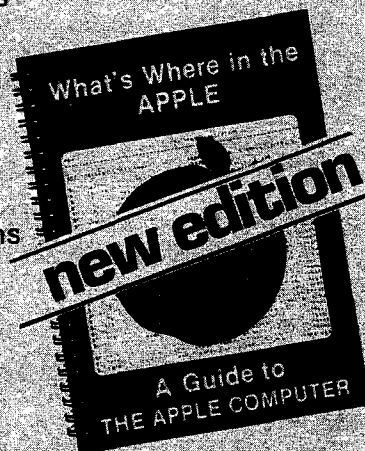
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backed, loose-leaf notebook. However, it is very good in the description of the syntax and use of Sysres. Each command is fully explained and examples are given.

**Reviewer:** Roger Crites

---

**Product Name:** **Smart Ascii**  
**Equip. req'd:** Commodore VIC-20 or '64 any memory configuration  
**Price:** \$59.95  
**Manufacturer:** Midwest Micro Associates  
P.O. Box 6148  
Kansas City, MO 64110

**Description:** *Smart Ascii* is a software/hardware package that interfaces the Commodore VIC-20 or '64 to any parallel printer using the "Centronics standard" protocol. The package consists of a cassette tape containing the software interface (there are separate versions for the VIC and '64, both on the same tape), and a three foot cable for connecting the computer to the printer via the user port.

**Pluses:** *Smart Ascii* is very easy to install and responds to the same type of commands as the VIC printer (OPEN, CMD, PRINT#). It has three very useful printing options: TRANSLATE translates selected control characters into a character string (reverse on becomes "(RVS)", etc.). "CBM" ASCII prints all uppercase, for program listings. "TRUE" ASCII prints upper and lowercase for word processing applications. The software is not protected and may be backed up to cassette or disk.

**Minuses:** The supplied cable is only three feet long. The software disables the RESTORE key, which makes life a little difficult if a program ends or is stopped with any of the screen or sound registers not reset.

**Documentation:** The documentation is very complete and clear. It is well organized, and includes a table of contents. A minor complaint is that the information concerning linefeed conventions and printer control codes, both of which are essential to proper operation of the printer, are hidden in the section labelled "Advanced Programmer Tips".

**Skill level required:** Minimal. Some knowledge of the printer being used may be required to set the linefeed convention correctly.

**Reviewer:** Michael Morris

---

**Product Name:** **Fundamentals of Mathematics**  
**Equip. req'd:** Commodore 64 with 1541 disk drive  
**Price:** 6-disk set-\$249.95  
3rd grade level only-\$69.95 (2 disks)  
5th grade level only-\$69.95 (2 disks)  
9th grade level only-\$99.95 (3 disks)  
Worksheets for Lessons/Programs  
1-89-\$29.95  
"Hands-on Preview" disk-\$9.95

**Manufacturer:** Sterling Swift Publishing Co.  
7901 South IH-35  
Austin, TX 78744  
(512)282-6840

**Description:** An educational set of 89 lessons and programs that may be used with children from the third grade on. The lessons cover mathematics from reading and writing two to seven digit whole numbers through equation solving and hit almost everything in between. The package is formatted for use by teachers in the classroom. Each lesson is backed up with worksheets which may be reproduced for classroom use by the students. The worksheets are broken up into pre-test, sample problem, problem, and post-test to allow use as needed to reinforce the learning process.

**Pluses:** The lessons are well done. In fact this is one of the best teaching packages I have worked with. When the problems are answered correctly the success is congratulated by terms such as: very good, fabulous, etc.. When a wrong answer is given, it is simply stated without any chastisement. At the end of each lesson, if more than 40% of the answers were given wrong, the program suggests that a review might help.

**Minuses:** The program were evidently translated from PET versions and do not made good use of the color, graphics and sound available from the Commodore 64.

**Documentation:** As the programs with their worksheets are self explanatory, not much addition documentation is needed or supplied. It tells how to use the programs and suggests methods for obtaining the best learning results from children whose needs vary.

**Skill level required:** The program set is made to be used in a learning environment. This does not limit them to teacher use only as a parent could make good use of them at home to help the children develop their skills in mathematics. Almost no specific computer knowledge is required.

**Reviewer:** Richard E. DeVore

---

**Product Name:** **C64-FORTH**  
**Equip. req'd:** Commodore 64 Computer; 1541 Disk drive & printer optional  
**Price:** \$49.95  
**Manufacturer:** Computer Marketing Services  
300 W. Marlton Pike  
Cherry Hill, NJ 08002  
(609)795-9480

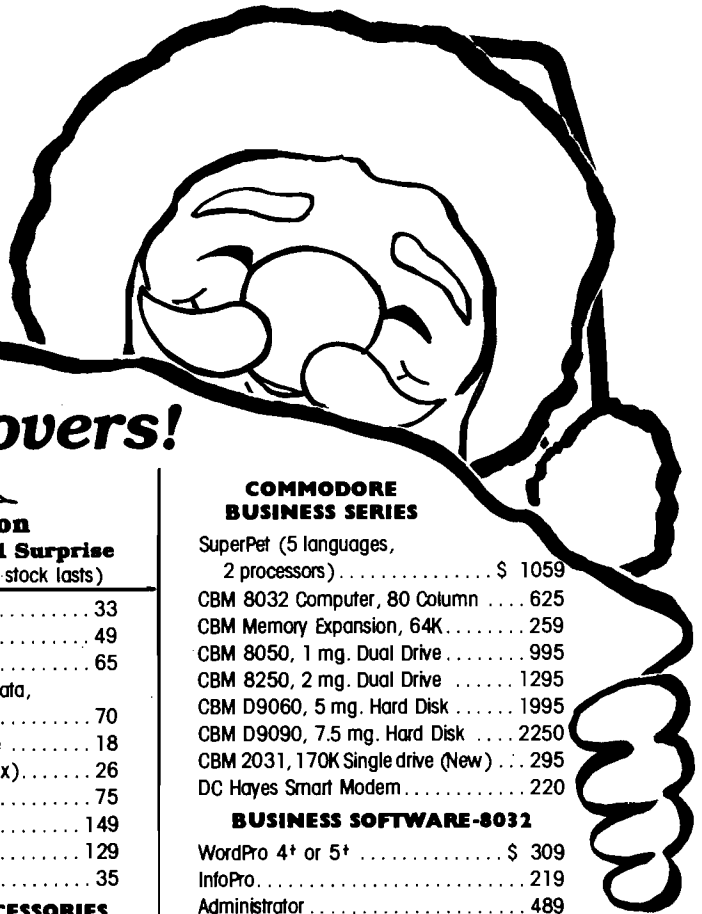
**Description:** *C-64 FORTH* is a cartridge based implementation of the language. It allows programming on the Commodore 64 with a language that is transportable between systems.

**Pluses:** It is extremely close to a standard version of FORTH and can be adapted to accept FORTH-79 standard

(Continued on page 38)

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CBM BX700	2990
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Calc Result (Easy)	75
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code. The language itself is extremely fast. It almost equals assembly language in its speed of operation. It is an excellent medium to write games in due to the speed of operation. Once learned, FORTH is much easier to write than assembly or machine language.

**Minuses:** The program does not come with sufficient information to start using it if you are not already familiar with the language. A disadvantage to someone who is used to using FORTH on another computer is the fact that it is supplied in a cartridge rather than on disk. Other implementations which I am familiar with are disk based. The manual does say that it is not a textbook on FORTH and supplies a list of reference material to help get you started.

**Documentation:** The 34 page User's guide & Reference Manual is broken into three parts. The first portion explains FORTH differences. The second and largest section contains a glossary of the words in C-64 FORTH while the third section explains how to get C-64 FORTH to work with FORTH-79 standard code. If you know something about FORTH or are willing to learn outside of the provided information, you will find that it is a good implementation. The manual, within the above limitations, presents the information clearly.

**Skill level required:** User who has progressed beyond the beginner stage.

**Reviewer:** Richard E. DeVore

**Product Name:** Passive Solar Design Program for Home Owners

**Equip. req'd:** Commodore 64 with 1541 disk drive or Dattasette

**Price:** \$99.95

**Manufacturer:** Don Danvlyk  
1538 Ohio Ave.  
Virginia Beach, VA 23454  
(804)425-7792

**Description:** A solar design program for the Commodore 64 that helps determine the effectiveness of your design. The program will help design add-on greenhouses or direct solar-gain passive structures. The choices are: a solar addition without heat storage; an addition with un-insulated heat storage; an addition with well insulated heat storage; and an addition using direct solar gain.

**Pluses:** The program gives a full financial breakout for each of your designs if desired. It also states whether or not the design is economically feasible. It does this through comparing heat savings to project cost and heat savings to interest that could have gotten from the same investment.

**Minuses:** The computations are approximate rather than actual. If you want to change a dimension while inputting your design, the program takes you back to the menu.

**Documentation:** Almost non-existent. The saving grace is that after trying the program several times, you won't need documentation.

**Skill level required:** Could be used by a beginning computerist.

**Reviewer:** Richard E. DeVore

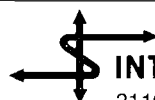
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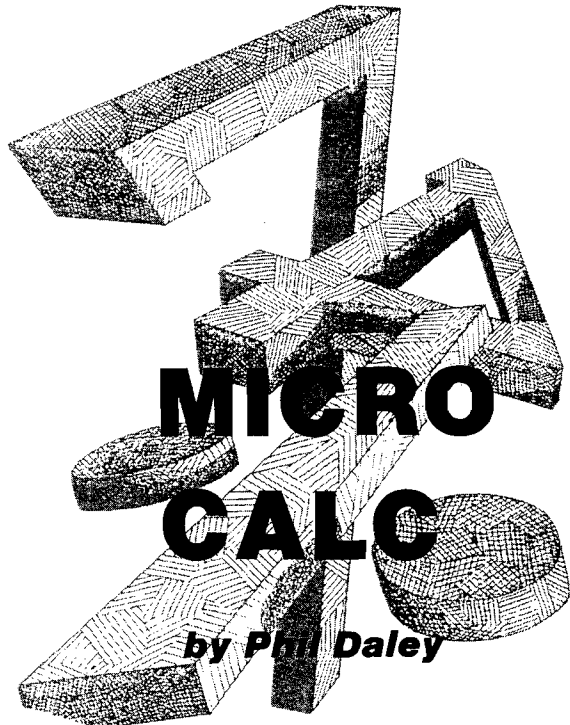


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### Typing in the Listing

The assembly listing is for reference only, the data statements for populating the machine language are contained in the BASIC program (listing 1). After seeing how the program works, line 760 can be changed to eliminate the initial screen each time the program runs.

#### Features:

- ✓ 256 memory lines
- ✓ 23 columns for comment fields
- ✓ support for
- ✓ optional zero
- ✓ multiple state
- ✓ display of disk file

### Operating Instructions

- @ performs calculations
- " zeros user variables
- ESC enters file mode
- Space enters comment field
- & clears screen
- right arrow moves up one line

#### Listing 1

```

10 REM * MICROCALC
20 REM * BY P. DALEY
30 REM * COPYRIGHT (C) 1983
40 REM * BY MICRO INK
50 FOR II = 1 TO 29:C$ = C$ + " ":NEXT C$ = C$ +
  "*"
60 D$ = CHR$(4): HOME : GOTO 550
70 VTAB XX: PRINT B$(XX);
80 IF MID$(B$(XX),2,1) = "?" THEN PRINT BB$(XX
  ):
90 IF XX = 24 THEN CALL - 868: GOTO 130 L
100 INVERSE
110 PRINT CHR$(BB): RIGHT$(C$,29 - LEN(B$(XX
  )) - LEN(BB$(XX)));
120 NORMAL : PRINT A$(XX);: CALL - 868: PRINT
130 RETURN G
140 XX = 1: GOSUB 70
150 AA = PEEK ( - 16384): IF AA < 127 THEN 150
160 IF FLAG = 1 THEN FLAG = 0: FOR II = 1 TO 24:B
  B$(II) = "":NEXT
170 POKE - 16368,0 B
180 AA = AA - 128
190 IF AA = 64 THEN FLAG = 1:BB = 32: GOSUB 70: GOTO
  400
200 IF AA = 38 THEN GOSUB 640:XX = 1: GOSUB 70: GOTO
  150
210 IF AA = 34 THEN GOSUB 1410: GOTO 150
220 IF AA = 44 OR AA = 59 OR AA = 93 THEN 350
230 IF AA > 39 AND AA < 95 THEN 320
240 BB = 32: GOSUB 70 D
250 IF AA = 32 THEN 360
260 IF AA = 13 THEN XX = XX + 1: IF XX > 23 THEN
  XX = 1
270 IF AA = 8 AND YY > 1 THEN B$(XX) = LEFT$(B$
  (XX), LEN(B$(XX)) - 1):YY = YY - 1: GOTO 290
280 IF AA = 8 AND YY = 1 THEN B$(XX) = "":YY = YY
  - 1
290 IF AA = 21 THEN XX = XX - 1: IF XX < 1 THEN X
  X = 23
300 IF AA = 27 THEN GOTO 1100
310 GOTO 340
320 YY = YY + 1: IF YY > 28 THEN BB = 32: GOSUB 70
  :XX = XX + 1:YY = 0: GOTO 340
330 B$(XX) = B$(XX) + CHR$(AA)
340 YY = LEN(B$(XX)):BB = 95: GOSUB 70
  
```

```

350 GOTO 150
360 VTAB XX: HTAB 31 C
370 INPUT A$(XX)
380 IF LEN(A$(XX)) > 9 THEN A$(XX) = LEFT$(A$
  (XX),9)
390 HTAB 1: GOSUB 70:XX = XX + 1: GOTO 340
400 FOR II = 1 TO 24:CT = 0:BUF = 511: POKE 216,0
410 IF LEN(B$(II)) < 2 THEN 530
420 IF MID$(B$(II),2,1) < ">" THEN 490 E
430 FOR JJ = 1 TO LEN(B$(II))
440 IF MID$(B$(II),JJ,1) = ":" THEN FG = 1: GOSUB
  470: GOTO 460
450 POKE BUF + JJ, ASC ( MID$(B$(II),JJ,1)):CT =
  CT + 1 F
460 NEXT JJ
470 POKE BUF + JJ,13:BUF = BUF - (CT + 1): DNERR
  GOTO 1360
480 CT = 0: CALL 768: IF FG = 1 THEN FG = 0: RETURN
490 IF MID$(B$(II),2,1) < ">" THEN 530
500 GOSUB 810
510 BB$(II) = " " + STR$(X1)
520 XX = II:BB = 32: GOSUB 70
530 NEXT II
540 XX = 1: GOTO 340
550 FOR II = 1 TO 29:S$ = S$ + " ":NEXT
560 S$ = "*" A
570 VTAB 5: PRINT S$: FOR II = 1 TO 10
580 PRINT S$: NEXT
590 PRINT S$: VTAB 8: HTAB 5: PRINT "MICRO CALC F
  OR APPLE"
600 VTAB 10: HTAB 5: PRINT "BY P. DALEY"
610 VTAB 12: HTAB 5: PRINT "COPYRIGHT (C) 1983"
620 DIM B$(25),A$(25),BB$(25)
630 GOSUB 690: GOTO 1190
640 INVERSE : VTAB 1
650 HOME
660 FOR II = 1 TO 23: PRINT C$
670 B$(II) = "":A$(II) = "
680 NEXT : GOSUB 1410: NORMAL : RETURN
690 FOR II = 768 TO 805 K
700 READ AA: POKE II,AA: NEXT
710 DATA 165,184,72,165,185,72,169,0,133,184
720 DATA 169,2,133,185,32,89,213,169,0,133
730 DATA 184,169,2,133,185,32,70,218,104,133
  
```

(Continued on next page)

## Listing 1 (continued)

```

740 DATA 185,104,133,184,96
750 DATA 104,104,96
760 REM RETURN:REM TAKE OUT FIRST REM TO REMOVE
    STARTUP VARIABLES
770 FOR II = 1 TO 15: READ A$(II),B$(II): NEXT
780 RETURN
790 DATA PRINCIPAL,A=8000,,,NUM MNTHS,M=48,,,INT
    RTE,I=11.9,,,MNTLY IR,I=I/1200,,,
800 DATA DIVISOR,D=(1-(1+I)^-M)/I,,,MONTH RTE,P=A
    /D,,,ROUND,P=INT(P*100+.5)/100,,,PAYMENT,P?
810 JJ = ASC ( LEFT$ ( B$(II),1) ) - 64
820 ON JJ GOTO 840,850,860,870,880,890,900,910,92
    0,930,940,950,960,970,980,990,1000,1010,1020,
    1030,1040,1050,1060,1070,1080,1090
830 RETURN
840 X1 = A: RETURN
850 X1 = B: RETURN
860 X1 = C: RETURN
870 X1 = D: RETURN
880 X1 = E: RETURN
890 X1 = F: RETURN
900 X1 = G: RETURN
910 X1 = H: RETURN
920 X1 = I: RETURN
930 X1 = J: RETURN
940 X1 = K: RETURN
950 X1 = L: RETURN
960 X1 = M: RETURN
970 X1 = N: RETURN
980 X1 = O: RETURN
990 X1 = P: RETURN
1000 X1 = Q: RETURN
1010 X1 = R: RETURN
1020 X1 = S: RETURN
1030 X1 = T: RETURN
1040 X1 = U: RETURN

```

I

```

1050 X1 = V: RETURN
1060 X1 = W: RETURN
1070 X1 = X: RETURN
1080 X1 = Y: RETURN
1090 X1 = Z: RETURN
1100 HOME : ONERR GOTO 1190
1110 VTAB 10: INVERSE : PRINT "S";
1120 NORMAL : PRINT "AVE OR ";
1130 INVERSE : PRINT "L";
1140 NORMAL : PRINT "OAD?";
1150 PRINT : PRINT "<RETURN> FOR CATALOG."
1160 GET A$: PRINT : IF ASC (A$) = 13 THEN PRINT
    D$"CATALOG": GET A$: GOTO 1100
1170 IF A$ = "S" THEN GOSUB 1200
1180 IF A$ = "L" THEN GOSUB 1270
1190 POKE 216,0: HOME : BB = 32: FOR XX = 1 TO 24:
    GOSUB 70: NEXT : BB = 95: HTAB 1: GOTO 140
1200 PRINT : PRINT "FILENAME?": INPUT F$:F$ = F$ +
    ".CAL":B$(24) = F$
1210 PRINT D$"OPEN"F$
1220 PRINT D$"WRITE"F$
1230 FOR II = 1 TO 25
1240 PRINT A$(II): PRINT B$(II)
1250 NEXT
1260 PRINT D$"CLOSE": RETURN
1270 PRINT : PRINT "FILENAME?": INPUT F$:F$ = F$ +
    ".CAL"
1280 PRINT D$"OPEN"F$
1290 PRINT D$"READ "F$
1300 FOR II = 1 TO 25
1310 INPUT A$(II)
1320 GET A$: IF A$ = CHR$ (13) THEN
1330 B$(II) = B$(II) + A$: GOTO 1320
1340 NEXT
1350 PRINT D$"CLOSE": RETURN
1360 POKE 216,0
1370 VTAB II: HTAB 23: FLASH
1380 PRINT "<-SYNTAX ERROR";
1390 NORMAL : CALL - 868: HTAB 1
1400 XX = 1: GOTO 340
1410 A = 0:B = 0:C = 0:D = 0:E = 0:F = 0:G = 0:H =
    0:I = 0:J = 0:K = 0:L = 0:M = 0:N = 0:O = 0:P
    = 0:Q = 0:R = 0:S = 0:T = 0:U = 0:V = 0:W =
    0:X = 0:Y = 0:Z = 0: RETURN

```

H

M

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## Listing 2

```

1          TTL "INPUTTING STATEMENTS"
2          *****
3          *
4          *   INPUTTING STATEMENTS
5          *   ON THE APPLE II
6          *
7          *   PHIL DALEY
8          *
9          TXTPTR  EPZ $88
10         INPUT   EQU $200
11         TOKEN   EQU $D559
12         LET     EQU $DA46
13         *
14         ORG $300
15         START  LDA TXTPTR
16                 PHA
17                 LDA TXTPTR+1
18                 PHA
19                 LDA #INPUT
20                 STA TXTPTR
21                 LDA /INPUT
22                 STA TXTPTR+1
23                 JSR TOKEN
24                 LDA #INPUT
25                 STA TXTPTR
26                 LDA /INPUT
27                 STA TXTPTR+1
28                 JSR LET
29                 PLA
30                 STA TXTPTR+1
31                 PLA
32                 STA TXTPTR
33         END    RTS
34         END

```

MICRO™

# APPLE CAT SORT

**A Catalog Sorter for the Apple II requires:**

**Apple II with at least 32K  
RAM, disk drive with DOS 3.3**

by Mark Harris

When I purchased my Apple II+ a few years ago, my first disk was a model of organization. With only a few programs on the disk, it was easy to find any one of them. Now, with dozens of disks and hundreds of files littered around my basement, I have become a victim of creeping overhead; an ever-increasing fraction of my time is devoted to locating files rather than using them. [Think about me with hundreds of disks—Ed.] I decided that one modest step towards putting things in order would be to alphabetize the catalog on each of my disks.

Of the 35 tracks on a standard DOS 3.3 disk, one (number 17) is set aside for keeping track of usage in the others. Most of the track is taken up by directory entries, each consisting of a file name and type, and a pointer to a track/sector list elsewhere on the disk. While these entries cannot be loaded or stored as a standard DOS file, they can be read and modified in a straightforward manner by the RWTS (Read or Write a Track and Sector) routine described on pages 94-98 of the DOS Manual. I set out to write a program which would read all current directory entries, sort them, and re-write them so that subsequent CATALOGs would list them in alphabetical order.

I first had to decide on what kind of sorting procedure to use, and whether to use BASIC or machine language. I started with the easiest combination to program: a simple bubble sort in BASIC. [For a description of all the sorts mentioned in this article, see [1].] After a few false starts (and destroyed directory tracks), I had the program functioning properly, but it took about two minutes to sort the catalog of a typical disk. I didn't know how the blame should be split between the slow speed of BASIC and my choice of sorting algorithm, so I replaced the bubble sort with the generally-faster Quick sort and tried again. The sorting time was reduced to one minute, but it was clear that BASIC was the primary culprit. I decided to throw in the towel and re-write the program in machine language. I also decided to use an insertion sort, which performs well for a short list (less than 50) that is already partially sorted. I thought this would be appropriate since (1) I anticipated

re-sorting my catalogs occasionally as new programs would be added, and (2) a disk cannot catalog more than 105 files, and typically has no more than 30 or 40.

The finished product listed in this article does the sort in under one second. The user is prompted by the program to insert the disk to be alphabetized into the drive (drive 1, slot 6) and to press the RETURN key. Then the program reads the directory entries, sorts them, re-writes them to disk, and calls the CATALOG routine in DOS. From the user's point of view, upon pressing RETURN he sees the alphabetized catalog in about the same length of time required for a standard CATALOG command. It is surprising to find that the disk has been updated in this short interval.

## Using the Program.

After you have keyed in and saved the program, a simple "BRUN CAT SORT" will get you under way. The program will ask for the disk to be alphabetized to be inserted into the drive. I *strongly* suggest trying the program first on disks that you have backed up, just in case you made a mistake in entering the program. Since the program tampers with track 17, which is critical to accessing the other tracks, any scrambling of data could result in the effective loss of all files on the disk. However, you can take some comfort from the fact that even if track 17 is completely clobbered, standard utilities such as "FIND T/S LISTS UTILITY" in [2] can reconstruct the disk.

## How the Program Works.

All of the secrets of direct access to directory entries are given in the DOS Manual. The pertinent information is given in the description of the RWTS routine (pp.94-98) and of the diskette directory (pp.129-131). Each file on a disk has a 35 byte entry in the diskette directory on track 17. The first two bytes give the track and sector number of the track/sector list associated with the file, which in turn lists the locations of the actual data sectors. Following the track and sector numbers is a one-byte code for the file type (text, binary, etc.), then 30 bytes for the file name. Finally, the last two bytes give the number of sectors used by the file.

The first byte of the entry actually doubles as a flag. If the associated file has been deleted, an "FF" is entered in this position. If the entry has never been opened, a "00" is used. Since neither value represents a legitimate track number for file storage (track 0 is used for DOS), there is no conflict involved. The idea behind CAT SORT is to keep reading entries into a table in RAM until a "00" is encountered as the first byte. As the entries are read, if the lead byte is not "FF", the RAM address of the entry is put into a separate table. When all entries have been read, the entry table and the address table are duplicated in memory. A sort is done by swapping addresses rather than entries (this greatly speeds up the process) in one of the tables. When this is accomplished, entries in one entry table pointed to by the sorted addresses are transferred to the other entry table in the correct order (at the positions pointed to by the remaining address table). The altered directory is written back to disk, and the CATALOG routine is called to show the fruits of these labors.

The sort used is very straightforward. An insertion sort

uses pretty much the same algorithm that most people would use for a manual sort of a few items. Suppose I want to alphabetize a stack of index cards, each of which has a single name on it. I start by taking the first two cards and swapping them if they are out of order. I take the third card and put it in the correct position in the first two. The fourth card is then inserted into the first three, and so on.

### Bibliography

1. H.S. Gentry, *Sorting Techniques Explained*, Kilobaud Microcomputing, Nov 81, pp.156-160.
2. Worth & Lechner, *Beneath Apple DOS*, Quality Software, Reseda, CA 1981.

**MICRO™**

You may contact Mark Harris at Dept. of Mathematical Sciences, Appalachian State University, Boone, NC 28608.

### Listing

```

* CAT SORT
* BY MARK HARRIS
* SORTS AND REWRITES THE
* CATALOG OF THE DISK IN
* DRIVE 1. USE ONLY WITH
* STANDARD DOS 3.3 DISKS

                START
DIR             GEQU  $FE
TBL1           GEQU  $FC
A1             GEQU  $3C
A2             GEQU  $3E
A4             GEQU  $42
CH             GEQU  $24
DOSWARM       EQU   $3D0
CATALOG       EQU   $A56E
MOVE          EQU   $FE2C
COUT          EQU   $FDED
RDKEY         EQU   $FDOC
HOME          EQU   $FC58
TABV          EQU   $FB5B

                ORG  $4200
0031 4200 A200  AGAIN  LDX  #$00
0032 4202 8E0002  STX  $200
0033 4205 85FC  STX  TBL1
0034 4207 9E6D44  STX  NUMADR
0035 420A 2058FC  JSR  HOME
0036 420D * PRINT TITLE AND WAIT FOR (RET):
0037 420D A90C  LDA  #$0C
0038 420F 8524  STA  CH
0039 4211 A902  LDA  #$02
0040 4213 205BFB  JSR  TABV
0041 4216 A971  LDA  #MSGTTL
0042 4219 85FE  STA  DIR
0043 421A A944  LDA  /MSGCTL
0044 421C 85FF  STA  DIR+1
0045 421E 205243  JSR  MOUT
0046 4221 A90C  LDA  #$0C
0047 4223 8524  STA  CH
0048 4225 A904  LDA  #$04
0049 4227 205BFB  JSR  TABV
0050 422A A920  LDA  #MSGNM
0051 422C 85FE  STA  DIR
0052 422E A944  LDA  /MSGNM
0053 4230 85FF  STA  DIR+1
0054 4232 205243  JSR  MOUT

```

```

0055 4235 A900  LDA  #$00
0056 4237 8524  STA  CH
0057 4239 A90A  LDA  #$0A
0058 423B 205BFB  JSR  TABV
0059 423E A98F  LDA  #MSGINS
0060 4240 85FE  STA  DIR
0061 4242 A944  LDA  /MSGINS
0062 4244 85FF  STA  DIR+1
0063 4246 205243  JSR  MOUT
0064 4249 200CFD  GETCR JSR  RDKEY
0065 424C C98D  CMP  #$8D
0066 424E D0F9  BNE  GETCR
0067 4250 * SET UP IOB FOR READING
        DIRECTORY ENTRIES
        * INTO $2000-2FFF:
        LDA  #1
        STA  IBCMD
        LDA  #$40
        STA  TBL1+1
        LDA  #$0F
        STA  IBSECT
        LDA  #$2F
        STA  IBUFF+1
        * KEEP READING SECTORS UNTIL A '00'
        * IS FOUND IN THE TRACK POSITION OF
        * A DIRECTORY ENTRY:
        LP1  STA  DIR+1
        JSR  RWTS
        LDA  #$B
        STA  DIR
        LDY  #$00
        NXTENT LDA  (DIR),Y
        BEQ  DONERD
        CMP  #DIR+1
        BEQ  ADD23
        LDA  DIR
        STA  (TBL1),Y
        INC  TBL1
        LDA  DIR+1
        STA  (TBL1),Y
        INC  TBL1
        INC  NUMADR
        ADD23 CLC
        LDA  #$23
        ADC  DIR
        STA  DIR
        BNE  NXTENT
        NXTSEC LDA  IBSECT
        CMP  #1
        BEQ  DONERD
        DEC  IBSECT
        DEC  IBUFF+1
        LDA  IBUFF+1
        JMP  LP1
        * COPY TRACK DUMP TO $3000-3FFF:
        DONERD LDA  IBUFF
        STA  A1
        STA  A4
        LDA  IBUFF+1
        STA  A1+1
        CLC
        ADC  #$10
        STA  A4+1
        LDA  #DIR+1
        STA  A2
        LDA  #$2F
        STA  A2+1
        JSR  MOVE
        * COPY $4000-40FF TO $4100-41FF:
        LDA  #$0
        STA  A1
        STA  A4
        LDA  #DIR+1
        STA  A2
        LDA  #$40
        STA  A1+1
        STA  A2+1

```

0131	42CD	A941	LDA	##41					
0132	42CF	8543	STA	A4+1					
0133	42D1	202CFE	JSR	MOVE					
0134	42D4		* DO INDEX SORT ON ADDRESS LIST AT \$4100:						
0135	42D4	20CE43	JSR	SORT					
0136	42D7	AD6B44	LDA	NUMADR					
0137	42DA	0A	ASL	A					
0138	42DB	8D6E44	STA	LSTBYT					
0139	42DE		* PUT ENTRIES IN ALPHABETICAL ORDER:						
0140	42DE		* MOVE ENTRIES INDEXED BY ADDRESS LIST AT						
0141	42DE		* \$4100 (POINTING TO \$3000-3FFF) TO						
0142	42DE		* TO POSITIONS (\$2000-2FFF) POINTED TO						
0143	42DE		* BY LIST AT \$4000.						
0144	42DE	A200	LDX	##00					
0145	42E0	BD0080	NXTMV	LDA	TABL1,X				
0146	42E3	85FC	STA	TBL1					
0147	42E5	BD0041	LDA	TABL2,X					
0148	42E8	85FE	STA	DIR					
0149	42EA	EB	INX						
0150	42EB	BD0080	LDA	TABL1,X					
0151	42EE	85FD	STA	TBL1+1					
0152	42F0	BD0041	LDA	TABL2,X					
0153	42F3	18	CLC						
0154	42F4	6910	ADC	##10					
0155	42F6	85FF	STA	DIR+1					
0156	42F8		* MOVE ENTRY POINTED TO BY (DIR) TO						
0157	42F8		* POSITION POINTED TO BY (TBL1).						
0158	42F8	204C44	JSR	MOVENT					
0159	42FB	EB	INX						
0160	42FC	EC6E44	CPX	LSTBYT					
0161	42FF	D0DF	BNE	NXTMV					
0162	4301		* WRITE SORTED LIST TO DISK:						
0163	4301	A902	LDA	##02					
0164	4303	8D6444	STA	IBCMD					
0165	4306	AD5D44	LDA	IBSECT					
0166	4309	8D6F44	STA	J					
0167	430C	A90F	LDA	##0F					
0168	430E	8D5D44	STA	IBSECT					
0169	4311	A92F	LDA	##2F					
0170	4313	8D6144	STA	IBBUFP+1					
0171	4316	204843	NXTWRT	JSR	RWTS				
0172	4319	AD5D44	LDA	IBSECT					
0173	431C	CD6F44	CMP	J					
0174	431F	F009	BEQ	FINISH					
0175	4321	CE5D44	DEC	IBSECT					
0176	4324	CE6144	DEC	IBBUFP+1					
0177	4327	4C1643	JMP	NXTWRT					
0178	432A	206EA5	FINISH	JSR	CATALOG				
0179	432D	A914	ASKAGN	LDA	##14				
0180	432F	85FE	STA	DIR					
0181	4331	A945	LDA	##45					
0182	4333	85FF	STA	DIR+1					
0183	4335	205243	JSR	MOUT					
0184	4338	200CFD	JSR	RDKEY					
0185	433B	C9D9	CMP	'Y'					
0186	433D	D003	BNE	EXIT					
0187	433F	4C0042	JMP	AGAIN					
0188	4342	2058FC	EXIT	JSR	HOME				
0189	4345	4CD003	JMP	DOSWARM					
0190	4348		* SUBROUTINES:						
0191	4348								
0192	4348								
0193	4348	A944	RWTS	LDA	/IOB				
0194	434A	A058	LDB	#IOB					
0195	434C	20D903	JSR	#D9					
0196	434F	E00E	BCS	ERROR					
0197	4351	60	RTS						
0198	4352								
0199	4352	A000	MOUT	LDB	##00				
0200	4354	B1FE	NXTOUT	LDA	(DIR),Y				
0201	4356	F006	BEQ	RET					
0202	4358	20EDFD	JSR	COUT					
0203	435B	C8	INY						
0204	435C	D0F6	BNE	NXTOUT					
0205	435E	60	RET						
0206	435F								
0207	435F	AD6544	ERROR	LDA	IBSTAT				
0208	4362	C910		CMP	##10				
0209	4364	D031		BNE	NOTWF				
0210	4366	2058FC		JSR	HOME				
0211	4369	A900		LDA	##00				
0212	436B	8524		STA	CH				
0213	436D	A908		LDA	##08				
0214	436F	2058FB		JSR	TABV				
0215	4372	A9CD		LDA	##MSGWF				
0216	4374	85FE		STA	DIR				
0217	4376	A944		LDA	/MSGWF				
0218	4378	85FF		STA	DIR+1				
0219	437A	205243		JSR	MOUT				
0220	437D	A900		LDA	##00				
0221	437F	8524		STA	CH				
0222	4381	A90A		LDA	##0A				
0223	4383	2058FB		JSR	TABV				
0224	4386	A9EC		LDA	##MSCPRESS				
0225	4388	85FE		STA	DIR				
0226	438A	A944		LDA	/MSCPRESS				
0227	438C	85FF		STA	DIR+1				
0228	438E	205243		JSR	MOUT				
0229	4391	200CFD		JSR	RDKEY				
0230	4394	4C0042		JMP	AGAIN				
0231	4397	2058FC	NOTWF	JSR	HOME				
0232	439A	A90F		LDA	##0F				
0233	439C	8524		STA	CH				
0234	439E	A908		LDA	##08				
0235	43A0	2058FB		JSR	TABV				
0236	43A3	A909		LDA	##MSGIGER				
0237	43A5	85FE		STA	DIR				
0238	43A7	A945		LDA	/MSGIGER				
0239	43A9	85FF		STA	DIR+1				
0240	43AB	205243		JSR	MOUT				
0241	43AE	A900		LDA	##00				
0242	43B0	8524		STA	CH				
0243	43B2	A916		LDA	##16				
0244	43B4	2058FB		JSR	TABV				
0245	43B7	A9EC		LDA	##MSCPRESS				
0246	43B9	85FE		STA	DIR				
0247	43BB	A944		LDA	/MSCPRESS				
0248	43BD	85FF		STA	DIR+1				
0249	43BF	205243		JSR	MOUT				
0250	43C2	200CFD		JSR	RDKEY				
0251	43C5	2058FC		JSR	HOME				
0252	43C8	4C2D43		JMP	ASKAGN				
0253	43CB	200CFD		JSR	RDKEY				
0254	43CE								
0255	43CE								
0256	43CE								
0257	43CE								
0258	43CE								
0259	43CE								
0260	43CE								
0261	43CE								
0262	43CE								
0263	43CE								
0264	43CE								
0265	43CE								
0266	43CE	A901							
0267	43D0	8D6F44							
0268	43D3	AD6F44							
0269	43D6	0A	JLP	ASL	A				
0270	43D7	AB		TAY					
0271	43D8	B90041		LDA	TABL2,Y				
0272	43DB	85EC		STA	KADR				
0273	43DD	C8		INY					
0274	43DE	B90041		LDA	TABL2,Y				
0275	43E1	85ED		STA	KADR+1				
0276	43E3	AC6F44		LDB	J				
0277	43E6	88		DEY					
0278	43E7	8C7044		STY	L				

(Continued on next page)



0279	43EA	AD7044	LLP	LDA	L	0355	4470	00	L	DC	H'00'
0280	43ED	0A		ASL	A	0356	4471				
0281	43EE	A8		TAY		0357	4471		* MESSAGE LIST:		
0282	43EF	B90041		LDA	TABL2, Y	0358	4471				
0283	43F2	85EE		STA	LADR	0359	4471	C3C1D4	MSGTTL	DC	C'CATALOG
0284	43F4	C8		INY			4474	C1CCCF			SORTER'
0285	43F5	B90041		LDA	TABL2, Y		4477	C7A0D3			
0286	43F8	85EF		STA	LADR+1		447A	CFD2D4			
0287	43FA	A003		LDY	#3		447D	C5D2			
0288	43FC	B1EC	NXTCHR	LDA	(KADR), Y	0360	447F	00		DC	H'00'
0289	43FE	D1EE		CMP	(LADR), Y	0361	4480	C2D9A0	MSGNM	DC	C'BY MARK
0290	4400	D007		BNE	DNCMP		4483	CDC1D2			HARRIS'
0291	4402	C021		CPY	#33		4486	CBA0C8			
0292	4404	F003		BEQ	DNCMP		4489	C1D2D2			
0293	4406	C8		INY			448C	C9D3			
0294	4407	D0F3		BNE	NXTCHR	0362	448E	00		DC	H'00'
0295	4409	900A	DNCMP	BCC	NXTITM	0363	448F	C9CE13	MSGINS	DC	C'INSERT DISK
0296	440B	AC7044		LDY	L		4492	C5D2D4			TO BE
0297	440E	C8		INY			4495	ACC4C9			ALPHAFETIZED'
0298	440F	203D44		JSR	RPLC		4498	D3CBA0			
0299	4412	4C3144		JMP	NXTJ		449B	D4CFA0			
0300	4415	AD7044	NXTITM	LDA	L		449E	C2C5A0			
0301	441B	0A		ASL	A		44A1	C1CCD0			
0302	4419	A8		TAY			44A4	C8C1C2			
0303	441A	C8		INY			44A7	C5D4C9			
0304	441B	C8		INY			44AA	DAC5C4			
0305	441C	A5EE		LDA	LADR	0364	44AD	8D		DC	H'8D'
0306	441E	990041		STA	TABL2, Y	0365	44AE	C9CEA0		DC	C'IN DRIVE 1
0307	4421	C8		INY			44B1	C4D2C9			AND PRESS
0308	4422	A5EF		LDA	LADR+1		44B4	D6C5A0			RETURN...'
0309	4424	990041		STA	TABL2, Y		44B7	B1A0C1			
0310	4427	CE7044		DEC	L		44BA	CEC4A0			
0311	442A	10BE		RPL	LLP		44BD	D0D2C5			
0312	442C	A000		LDY	#00		44C0	D3D3A0			
0313	442E	203D44		JSR	RPLC		44C3	D2C5D4			
0314	4431	EE6F44	NXTJ	INC	J		44C6	D5D2CE			
0315	4434	AD6F44		LDA	J		44C9	AEAEAE			
0316	4437	CD6D44		CMP	NUMADR	0366	44CC	00		DC	H'00'
0317	443A	D09A		BNE	JLP	0367	44CD	D2C5CD	MSGWP	DC	C'REMOVE
0318	443C	60		RTS			44D0	CFD6C5			WRITE-PROTECT
0319	443D	98	RPLC	TYA			44D3	A0D7D2			TAB, THEN'
0320	443E	0A		ASL	A		44D6	C9D4C5			
0321	443F	AB		TAY			44D9	ADD0D2			
0322	4440	A5EC		LDA	KADR		44DC	CFD4C5			
0323	4442	990041		STA	TABL2, Y		44DF	C3D4A0			
0324	4445	A5ED		LDA	KADR+1		44E2	D4C1C2			
0325	4447	C8		INY			44E5	ACA0D4			
0326	4448	990041		STA	TABL2, Y		44E8	C8C5CE			
0327	444B	60		RTS		0368	44EB	00		DC	H'00'
0328	444C					0369	44EC	D0D2C5	MSGPRESS	DC	C'PRESS ANY
0329	444C	A000	MOVENT	LDY	#00		44EF	D3D3A0			KEY TO
0330	444E	B1FE	NXTBT	LDA	(DIR), Y		44F2	C1CED9			CONTINUE...'
0331	4450	71FC		STA	(TBL1), Y		44F5	A0C9C5			
0332	4452	C8		INY			44FB	D9A0D4			
0333	4453	C023		CPY	#23		44FB	CFA0C3			
0334	4455	D0F7		BNE	NXTBT		44FE	CFCEB4			
0335	4457	60		RTS			4501	C9CED5			
0336	4458						4504	C5AEAE			
0337	4458		IOB	EQU	*		4507	AE			
0338	4458	01	IBTYPE	DC	H'01'	0370	4508	00		DC	H'00'
0339	4459	60	IBSLOT	DC	H'60'	0371	4509	C9AFCF	MSGIDER	DC	C'I/O ERROR.'
0340	445A	01	IBRRVN	DC	H'01'		450C	A0C5D2			
0341	445B	00	IBVOL	DC	H'00'		450F	D2CFD2			
0342	445C	11	IBTRK	DC	H'11'		4512	AE			
0343	445D	00	IBSECT	DC	H'00'	0372	4513	00		DC	H'00'
0344	445E	6944	IBDCTP	DC	A'DEVTPC'	0373	4514	8D8D	MSGACN	DC	H'SIDP'
0345	4460	002F00	IBBUFP	DC	H'002F0000'	0374	4516	D3CFD2		DC	C'SORT
	4463	00					4519	D4A0C1			ANOTHER DISK?
0346	4464	00	IBCMD	DC	H'00'		451C	CECFD4			(Y,N)'
0347	4465	00	IBSTAT	DC	H'00'		451F	C8C5D2			
0348	4466	00	IBSMOD	DC	H'00'		4522	A0C4C9			
0349	4467	60	IDFPRN	DC	H'60'		4525	D3CBEF			
0350	4468	01	IOBPN	DC	H'01'		4528	A0ABD9			
0351	4469	0001EF	DEVTPC	DC	H'0001EFD8'		452E	ACCEA9			
	446C	D8					452E	A0			
0352	446D	00	NUMADR	DC	H'00'	0375	452F	00		DC	H'00'
0353	446E	00	LSTBYT	DC	H'00'	0376	4530				
0354	446F	00	J	DC	H'00'	0377	4530			END	



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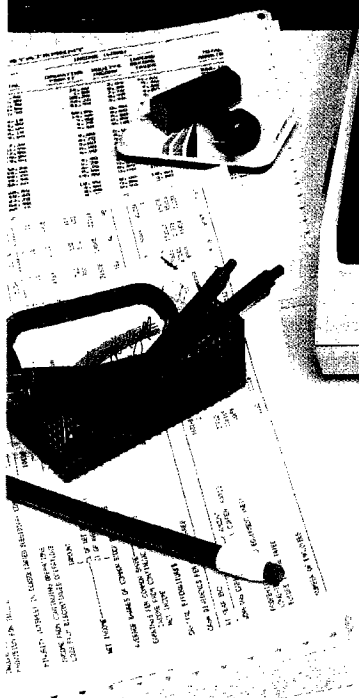
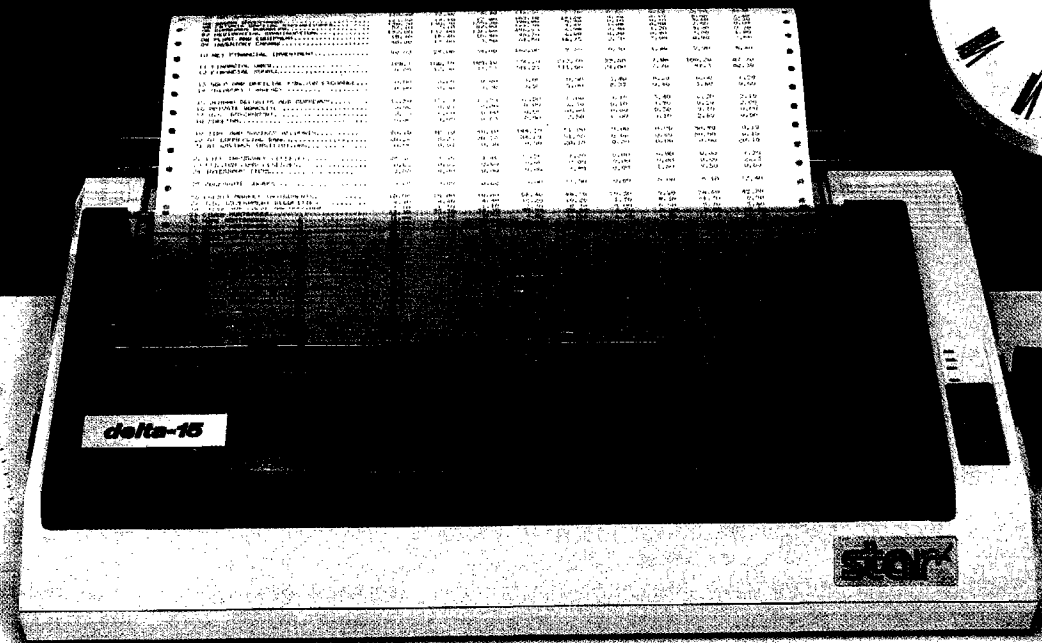
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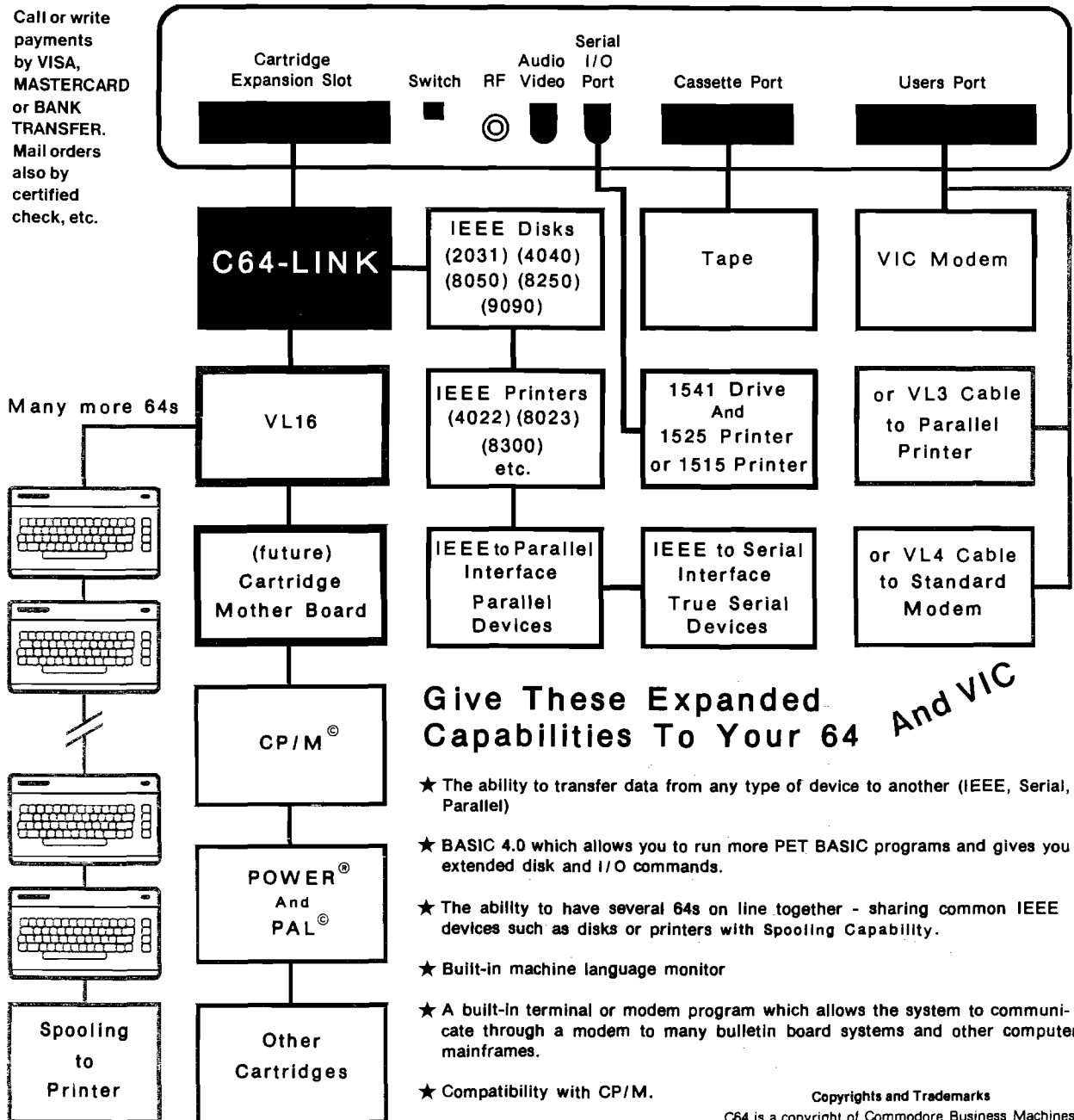
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# Master Directory For The Apple

By Charles Hill

*(Editor's note: This program is much longer than we normally publish. Since we think this is such an outstanding program (similar commercial ventures sell for over \$100), we are publishing it in two pieces. This month contains all the main routines for the menu and reading/writing the library file. Next month we will conclude the program with the print and sort routines.)*

**I**t never fails. No matter how hard you try to keep your disk library in some semblance of rational order, it never seems to remain that way for long. Files that you know are on a particular disk have disappeared, and others have mysteriously moved from one disk to another. If this sounds familiar to you, then here is the solution. MASTER DIRECTORY allows you to create one large file directory containing all the CATALOGS of your disks. There is room for 64 disk IDs and 1100 file names. This directory can be sorted and printed in a variety of ways and saved to disk for use later or by other programs.

## Operating Instructions

To get started, simply type "BRUN MASTER DIRECTORY". The main menu will then be displayed — six options are available. Press the key corresponding to the number of your choice. If you make a mistake, press return as the next input and you will be returned to the menu.

The first option is to read the in-

Keep all your disk directories on a master file. Sort and Print the file for a quick reference to all your programs.

dividual disk directories. The program can only read DOS 3.3 disks. Pascal and CP/M disks use a different directory format and protected disks can't be read at all. To read the disk, insert it in drive one, enter the disk ID (1 to 8 characters) and press return. When you have CATALOGED all your disks, press return to re-enter the main menu.

The next two options allow the master directory to be saved to or read from the disk. Insert the disk into drive 1 and enter the filename. Any DOS errors that occur will be trapped and the appropriate error message printed.

Option 4 is for sorting the directory. A Shell-Metzner sort is used — it can sort 360 entries on two fields in nine seconds. To select the sort fields, enter the number next to the field name on the sort menu. One to three fields can be entered in any order. The first field entered is the most important descending to the last entered being the least important. The sort returns to the main menu when finished.

Printing the directory is the fifth option. Similar to the sort, up to three fields can be entered for printing in any desired order. To select the field, enter the number of the field from the sort mini-menu. A page eject is issued after each 65 lines. Be sure that top-of-form is set to the top of the page before printing. If this is not done, page breaks will occur during the middle of

a page. This routine also returns to the main menu.

The last option restores normal DOS and does a BASIC cold-start.

## The Program

The program doesn't have a search function because in the time taken to load the directory and find the desired file name will take longer than to look it up in an alphabetized list kept next to your Apple. I keep one of these lists handy at all times. It has proven an invaluable time saver.

The first step is to set MAXFILES equal to 1. Modifications are made to DOS to allow direct access through use of machine language. This technique was described by William Reynolds III in his article *Using Text Files From Machine Language* in NIBBLE (2:2). Another modification allows the interception of DOS errors after the error message has been printed. The menu box is then set up and protected by lowering the top of the text screen. HIMEM is then lowered by 32 bytes to prevent overwriting DOS. The main loop is entered and a keypress is checked for to choose the correct subroutine. After completion of the main program, DOS is restored to its original condition and the program jumps to BASIC.

*(Continued on next page)*

The routine to read the CATALOG first zeroes the disk ID buffer. Each disk ID is stored in this buffer with an index to this name stored with each filename. The reading of individual entries is simple — consecutive directory sectors are read and processed. Each entry is checked to see if it was deleted or the end of the directory. When a good entry is found, the disk index, file type and file name are copied into the name buffer. The buffer pointer is incremented and a memory check is done with appropriate error handling. Then the next entry is read.

The routines to read and save the name file on disk enter the values normally set by BSAVE and BLOAD. Drive 1 is defaulted in the program, however, this may be changed. You may wonder why I use DOS directly rather than printing the commands (preceded by CTRL-D) to execute them. The reason is that DOS stores the letters of a command being printed in the input buffer at \$200. Since this is the buffer where I was reading the filename from while it was being printed, some very strange conflicts occurred. This problem took some time to find, but the new arrangement works perfectly. One item not

mentioned in Reynold's article is that the KEY WORDS FOUND byte at \$AA65 must be set appropriately for some routines to work correctly. The following is a list of these values (Table 1):

KEYWORD	VALUE
C	\$C0
I	\$A0
O	\$90
V	\$40
D	\$20
S	\$10
L	\$08
R	\$04
B	\$02
A	\$01

TABLE 1.

For example, with the BSAVE command, both the Address and Length parameters must be specified, so \$08 + \$01 = \$09. On the other hand, no parameters need be specified with a BLOAD, so the value is \$00.

The Shell-Metzner sort has appeared innumerable times with full ex-

planations in MICRO and other magazines, so I won't go into any detail here. The only part I will mention is the comparison of Disk IDs. For the file type and name, a direct comparison is made in the entries in the file names buffer. The disk ID is a single number of no alphabetic significance. It must first be converted to an address in the disk ID buffer. The IDs then pointed at are compared and a swap of the entries in the buffer made, if needed. The disk IDs are never reordered, they stay in the buffer in their original entry order and are accessed by pointer only.

There is a ROM multiply routine that I recently discovered that may be of use in your own programming. Put the numbers to be multiplied in \$64,65 and \$AD,AE. After calling \$E2B8, the result returns in the X register (low) and Y register (high).

After getting the numbers corresponding for the fields to be printed, the print routine converts these numbers to a range of 0-2. This value is used to test which field to print. The printer is initialized with a "PR#1". If your printer requires additional initialization, you will have to insert this code into the routine or it may be possible to initialize the printer before running the MASTER DIRECTORY program. The needed titles are printed and the fields are printed centered under the titles. The disk ID and file name are copied directly from the buffer. The file type is printed by borrowing some code from DOS at \$ADDB with some changes so that LISA files are indicated with an "L". When the printing is finished, a "PR#0" disconnects the printer.

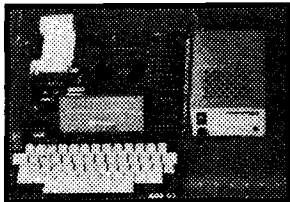
### Modifications

One useful modification would be to write additional CATALOG read subroutines that could read Pascal, CP/M, Flex or OS9 directories. The code is not that complex so that changing the tracks/sectors and bytes read should be straightforward. If you need more information — the file size, disk volume number, free space remaining or other parameters — it can be read from the disk, stored and printed. Those of you with a 16K (or larger) RAM card can increase the buffer size by expanding into the additional RAM.

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**Master Directory  
requires:**

Apple II with DOS

```

1 * MASTER DIRECTORY
* BY CHARLES HILL
* MICRO INK
* AMHERST, NH 03031
*
* ZERO PAGE DEFINITIONS
BUFFER EPZ $EE ; DIRECTORY BUFFER
; POINTER
WINTOP EPZ $22 ; TOP OF TEXT WINDOW
PROMPT EPZ $33 ; INPUT PROMPT
MAX EPZ $F0 ; SORT VARIABLES
J EPZ $F2 ;
K EPZ $F4 ;
HFTR EPZ $F6 ;
VFTR EPZ $F8 ;
H EPZ $FA ;
V EPZ $FC ;
FLDPOS EPZ $EA ; FIELD POSITION TABLE
(1,2,3) FOR SORT

IDBUFR EPZ $FE ; DISK ID BUFFER
; POINTER
CV EPZ $25 ; VERTICAL CURSOR POS.
CH EPZ $24 ; HORIZONTAL CURSOR
; POS.
NUMIDS EPZ $F0 ; NUMBER OF DISK ID'S
FLDFTR EPZ $E9 ; POINTER TO FLDFTR
; TABLE
MAXMY EPZ $E8 ; MAXIMUM Y VALUE
COUNT EPZ $F0 ; NUMBER OF NAMES
; USED BY PRINT
NUMLINES EPZ $F2 ; # OF LINES PRINTED
PRINTFLD EPZ $EA ; TABLE OF PRINT
; FIELDS
PRNTBUF EPZ $F4 ; TEXT POINTER
HIMEM EPZ $E6
*
* ROM AND DOS DEFINITIONS
*
CROUT EQU $FD8E ; CARRIAGE RETURN
RDKEY EQU $FDOC ; GET A KEYPRESS
HOME EQU $FC58 ; GUESS WHAT?
GETLNZ EQU $FD67 ; GET INPUT LINE
COUT EQU $FD6D ; PRINT CHAR. INA REG.
RDSCTR EQU $B011 ; READ A DISK SECTOR
DIRIDX EQU $B39C ; INDEX INTO DIRECTORY
DIRBGN EQU $B4C6 ; START OF DIRECTORY
; ENTRIES
RDVTOC EQU $AFF7 ; READ VTOC ROUTINE
NXTONE EQU $B230 ; ROUTINE TO ADVANCE
; DIRECTORY INDEX
DOSNAME EQU $AA75 ; NAME BUFFER FOR DOS
VOL EQU $AA66 ; PARAMETERS FOR DOS
DRIVE EQU $AA68
SLOT EQU $AA6A
LEN EQU $AA6C
ADDR EQU $AA72
KYWRDFND EQU $AA65 ; KEYWORDS FOUND BYTE
    
```

```

DOCDMND EQU $A186 ; ROUTINE TO DO DOS
; COMMAND
COMND EQU $AA5F ; DOS COMMAND
BLANKNAM EQU $A095 ; ROUTINE TO BLANK
; NAME BUFFER
VTAB EQU $FC24 ; VTOC ROUTINE
ROMULT EQU $E2B8 ; ROM MULTIPLY ROUTINE
MAXFILES EQU $A258 ; MAXFILES ROUTINE
SETINO EQU $FE89 ; DO IN#0
SETOUTO EQU $FE93 ; DO PR#0
SETOUT EQU $FE95 ; DO PR#SLOT
*
* WORKING DEFINITIONS
*
IDBUFR EQU $0EFO ; DISK ID BUFFER
NUMBER EQU IDBUFR-$02 ; NUMBER OF ENTRIES
; IN BUFFERS
NAMEBUFR EQU IDBUFR+$0200 ; FILE NAMES BUFFER
INBUFR EQU $0200 ; INPUT BUFFER
MAXLINE EQU 65 ; NUMBER OF LINES PER
; PRINTED PAGE
*
* MAIN PROGRAM
*
JSR MENU ; SET UP THE SCREEN
SEC ; SET HIMEM TO POINT
; BELOW ACTUAL HIMEM
LDA $73
SBC #$20
STA HIMEM
LDA $74
SBC #0
STA HIMEM+1
LDA #")"
STA PROMPT
COMMAND JSR HOME ; DETERMINE DESIRED
; ROUTINE AND JUMP TO
; IT
LDA #")"
JSR COUT
JSR RDKEY
CMP #")"
BNE >1
JMP SCANDISK
*1 CMP #")"
BNE >2
JMP SAVECAT
*2 CMP #")"
BNE >3
JMP READCAT
*3 CMP #")"
BNE >4
JMP SORTCAT
*4 CMP #")"
BNE >5
JMP PRINTCAT
*5 CMP #")"
BNE COMMAND
LDA #00 ; SET FULL WINDOW
STA WINTOP
JSR HOME
LDA #$A5
STA $A851 ; RESTORE NORMAL DOS
LDA #$A2
STA $9EE0
LDA #$20
STA $A6EF
LDA #$51
STA $A6F0
LDA #$A8
STA $A6F1
JMP $03D3 ; COLD-START DOS
*
* ROUTINE TO READ CATALOG
*
SCANDISK LDA #$31 ; INV "1"
STA $502
    
```

```

LDA #0
STA NUMBER ;ZERO NUMBER OF
STA NUMBER+1 ;FILE NAMES
LDA #NAMEBUFR
STA BUFFER ;SET BUFFER POINTERS
LDA /NAMEBUFR
STA BUFFER+1
LDA #FF
STA NUMIDS ;ZERO NUMBER OF DISK IDS
LDA #A0 ;BLANK DISK ID BUFFER
LDY #0
^1 STA IDBUFR,Y
STA IDBUFR+$0100,Y
INY
BNE <1
NEXTDISK JSR HOME
JSR GETID ;GET ID FOR DISK
BCS >1 ;BRANCH IF ID ENTERED
^4 LDA #B1 ;NORM "1"
STA $502
JMP COMMAND
^1 JSR RDVTOC ;READ VTOC
CLC ;SET TO READ FIRST SECTOR
RDSECT JSR RDSCTR ;AND READ IT
BCS NEXTDISK ;CHECK FOR END OF DIRECTORY
SECTORS

NXTNAM LDX #00
STX DIRIDX ;RESET DIR. INDEX
LDA DIRBGN,X ;GET FIRST BYTE OF THIS ENTRY
BEQ NEXTDISK ;CHECK FOR END OF DIRECTORY
BMI NXTENT ;CHECK FOR DELETED ENTRY
LDY #00
LDA NUMIDS ;GET DISK ID NUMBER
STA (BUFFER),Y ;STORE IT WITH NAME
INX ;ADVANCE POINTER TO FILE
TYPE
^1 INX ;MOVE FILE TYPE AND NAME
INY
LDA DIRBGN,X
STA (BUFFER),Y
CPY #1F
BNE <1
INC NUMBER ;INCREMENT NUMBER OF
ENTRIES
BNE >2
^2 INC NUMBER+1
CLC ;INCREMENT BUFFER
POINTERS

LDA BUFFER
ADC #20
STA BUFFER
BCS >1
INC BUFFER+1
^1 LDA BUFFER ;CHECK FOR OUT OF
MEMORY

CMP HIMEM
LDA BUFFER+1
SBC HIMEM+1
BLT NXTENT
LDX #OUTBL ;YES WE ARE
LDY /OUTBL
JSR PRINTMES
JSR RDKEY
JMP <4
OUTBL HEX 8787
ASC "OUT OF MEMORY!"
HEX 878D00
NXTENT JSR NXTONE ;POINT TO NEXT FILE
ENTRY
BCS RDSECT ;NO MORE SO READ NEXT
SECTOR
BCC NXTNAM ;MORE IN THIS SECTOR

*
* ROUTINE TO GET DISK ID
*
GETID LDX #IDTBL ;REQUEST ID

```

```

LDY /IDTBL
JSR PRINTMES
JSR GETLNZ ;GET ID
INC NUMIDS ;INC NUMBER OF IDS
LDA NUMIDS ;POINT TO FREE AREA
JSR POINTID
LDY #0 ;MOVE DISK ID TO
IT'S BUFFER
^2 LDA INBUFR,Y
CMP #BD ;TEST FOR END OF LINE
BEQ >1
STA (IDBUFR),Y
INY
CPY #0B ;TEST FOR END OF ID
BNE <2
^1 CPY #01 ;TEST FOR NO ID (RTN
FIRST CHAR.)

RTS
IDTBL ASC "INSERT DISK, AND ENTER ID"
HEX 8D
ASC "JUST PRESS RETURN TO EXIT"
HEX 8D00

*
* ROUTINE TO SAVE CATALOG TO DISK
*
SAVECAT LDA #32 ;INV "2"
STA $582
JSR HOME ;GET FILENAME
JSR GETNAME ;GET FILENAME
TXA
BEQ >2
LDA #4B ;BSAVE COMMAND
STA COMND
LDA #09 ;SET KEYWORDS FOUND
BITS TO
STA KYWRDFND ;SHOW 'A' AND 'L'
PARAMETERS

LDX NUMBER ;SET LENGTH PARAMETER
LDY NUMBER+1 ;GET LENGTH OF NAME
AREA

JSR MULT
CLC
TXA
ADC #03 ;ADD LENGTH OF
NUMBER OF ENTRIES
STA LEN ;AND DISK ID AREA
TYA
ADC #02
STA LEN+1
JSR DOCOMND ;AND DO IT!
LDA #B2 ;NORM "2"
STA $582
JMP COMMAND

*
* ROUTINE TO READ CATALOG FILE
*
READCAT LDA #33 ;INV "3"
STA $602
JSR HOME ;GET FILENAME
JSR GETNAME ;GET FILENAME
TXA
BEQ >1
LDA #0
STA KYWRDFND ; BLOAD COMMAND
LDA #50
STA COMND
JSR DOCOMND ;DO IT
LDA #B3 ;NORM "3"
STA $602
JMP COMMAND

*
* ROUTINE TO HANDLE DISK ERRORS
*
DISKERR LDX #ERRMESS ;PRINT MESSAGE
LDY /ERRMESS
JSR PRINTMES
JSR RDKEY ;WAIT FOR KEYPRESS

```

(Continued on page 55)

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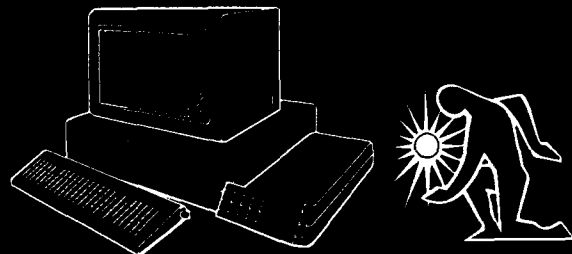
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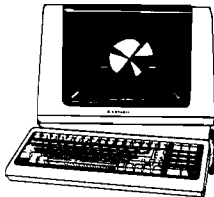
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```

LDA $602          ;CHECK TO SEE IF WE
                  WERE
CMP #33          ;READING OR WRITING
BEQ <1          ;AND
BNE <2          ;RETURN
ERRMESS ASC "DISK ERROR, PRESS ANY KEY TO
              CONTINUE"
              HEX 87878D00
*
* GET DISK AND FILENAME
*
GETNAME LDX #GETMESS
        LDY /GETMESS
        JSR PRINTMES
^2      JSR GETLNZ          ;GET FILENAME
        TXA
        BEQ >3
        JSR BLANKNAM      ;BLANK FILENAME
                          BUFFER
        LDY #00          ;MOVE FILENAME TO
                          DOS NAME BUFFER
^1      LDA INBUFF,Y
        CMP #8D
        BEQ SETPARMS
        STA DOSNAME,Y
        INY
        BNE <1
SETPARMS LDA #0          ;SET PARAMETERS
        STA VOL
        LDA #6
        STA SLOT
        LDA #1
        STA DRIVE
        LDA #NUMBER      ;SET STARTING ADDRESS
        STA ADDR
        LDA /NUMBER
        STA ADDR+1
^3      RTS
GETMESS ASC "INSERT DISK, AND ENTER FILENAME"
        HEX 8D8D00
*
*
* THIS IS WHERE THE SORT ROUTINE
* GOES. WILL BE IN NEXT MONTH
SORTCAT EQU *
        RTS
*
*
MULT     STY $65          ;MULTIPLY ROUTINE
        STX $64          ;$64,$65 * $AD,$AE
        LDA #$20
        STA $AD
        LDA #$00
        STA $AE
        JMP ROMULT
*
*
* THIS IS WHERE THE PRINTCAT ROUTINE
* GOES. ALSO WILL BE IN NEXT MONTH.
PRINTCAT EQU *
        RTS
*
*
* TEXT PRINTER
*
PRINTMES STX PRNTBUF
        STY PRNTBUF+1
        LDY #00
^1      LDA (PRNTBUF),Y
        BEQ >2
        JSR COUT
        INY
        BNE <1
^2      RTS
;
POINTID STA IDBUFFR      ;GIVEN A AS AN INDEX
        LDA #00          ;TD THE ID TABLE

```

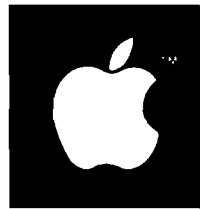
```

STA IDBUFFR+1    ;POINT THE THE
                  CORECT PLACE
^1      LDX #00          ;BY MULTIPLYING BY 8
        ASL IDBUFFR
        ROL IDBUFFR+1
        INX
        CPX #03
        BNE <1
        CLC
        LDA IDBUFFR
        ADC #IDBUFF
        STA IDBUFFR
        LDA IDBUFFR+1
        ADC /IDBUFFR
        STA IDBUFFR+1
        RTS
;
; MENU
MENU     JSR HOME          ;PRINT THE MENU BOX
        LDA #1
        JSR MAXFILES      ;SET MAXFILES = 1
        LDA #$60
        STA $A851        ;PATCH DOS
        STA $9EE0        ;" "
        LDA #$4C
        STA $A6EF
        LDA #DISKERR
        STA $A6F0
        LDA /DISKERR
        STA $A6F1
        JSR SETINO
        JSR SETOUTO
        LDX #MENUTEXT
        LDY /MENUTEXT
        JSR PRINTMES
BOX      LDA #00          ;FRAME THE MENU
        STA CV
        JSR VTAB
        LDY #0
        STY CH
        LDA #"#"
        LDX #38
^1      JSR COUT
        DEX
        BPL <1
        LDX #08
^1      LDY #39
        STY CH
        JSR COUT
        JSR COUT
        DEX
        BPL <1
^1      LDA #0C          ;SET THE TEXT WINDOW
                          DOWN TO
        STA WINTOP        ;PROTECT THE MENU BOX
        RTS
MENUTEXT HEX 8D8D
        ASC " 1) CATALOG DISKS"
        HEX 8D
        ASC " 2) SAVE CATALOG "
        ASC "ENTER THE NUMBER"
        HEX 8D
        ASC " 3) READ CATALOG"
        HEX 8D
        ASC " 4) SORT CATALOG "
        ASC "OF YOUR CHOICE."
        HEX 8D
        ASC " 5) PRINT CATALOG"
        HEX 8D
        ASC " 6) END"
        HEX 8D00
        FLDLEN HEX 08          ;DISK ID LENGTH
        HEX 01          ;FILE TYPE LENGTH
        HEX 1E          ;FILE NAME LENGTH
        END

```

# MICRO™

## Apple Slices



by Phil Daley

### Disk Dump Program

Here is a program to dump any disk file to screen, printer or whatever. The program asks for what type of disk you have, and then asks for the filename. If you don't know the name, a RETURN will present the possibilities. The dump can either be HEX or straight ASCII. If the file is not straight text, your printer will probably go through a few contortions in the ASCII mode. The program currently has subroutines for DOS and Pascal. I will add subroutines for CP/M, Flex and OS-9 soon.

Listing 1

```

5 DIM A(150),B(150):BU = 16384:GOSUB 9000
10 TEXT : HOME : VTAB 7: PRINT "DISK TYPE":
  PRINT "1. DOS 3.3":A: PRINT "2. PASCAL"
  A: PRINT "3. CPM": PRINT "4. FLEX": PRINT
  "5. OS-9":P: PRINT "CHOOSE ": GET
  A$:A = VAL (A$): IF A < 1 OR A > 5 THEN
  10
81 PRINT : PRINT "SLOT FOR OUTPUT? ": GET
  A$:SL = VAL (A$): IF SL < 0 OR SL > 7 THEN
  81
85 PRINT : PRINT "HEX OR ASCII?": GET HE$:
  HE = 0: IF HE$ = "H" THEN HE = 1
90 TEXT : HOME : PRINT "INSERT DISK": PRINT
  : PRINT "FILENAME?": PRINT : PRINT "<RE
  TURN> FOR CATALOG ": INPUT B$:A$ = "":C
  F = 0: IF LEN (B$) = 0 THEN CF = 1: GOTO
  110
105 A$ = B$
110 HOME : VTAB 7: PRINT "READING CATALOG..
  ..": ON A GOSUB 1000,2000,3000,4000,500
  0: INPUT "PRESS <RETURN>":A$: GOTO 10: END

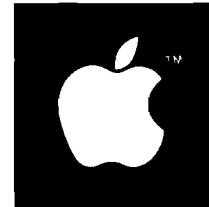
900 HI = INT (H / 16):LO = H - HI * 16:D =
  HI:GOSUB 950:A$ = H$:D = LO:GOSUB 950
  :A$ = A$ + H$ + " ": RETURN
950 IF D < 10 THEN H$ = STR$ (D): RETURN
960 H$ = CHR$ (D + 55): RETURN
1000 FOR I = 1 TO LEN (B$):A$ = A$ + CHR$
  (ASC (MID$ (B$,I,1)) + 128): NEXT : POKE
  780,17: POKE 785,64: FOR C = 15 TO 2 STEP
  - 1: POKE 781,C: CALL 768: FOR Y = 0 TO
  6:E$ = "":EN = 16395 + Y * 35:Q = PEEK
  (EN): IF Q = 0 THEN C = 2:Y = 6: GOTO 1
  070

```

```

1030 FOR X = EN + 3 TO EN + 32:E$ = E$ + CHR$
  (PEEK (X)): NEXT : IF CF THEN PRINT E
  $: GOTO 1070
1065 IF A$ = LEFT$ (E$, LEN (A$)) THEN 110
  0
1070 NEXT : NEXT
1085 IF CF THEN RETURN
1090 FLASH : PRINT : PRINT "NOT FOUND": NORMAL
  : RETURN
1100 POKE 780, PEEK (EN): POKE 781, PEEK (E
  N + 1): CALL 768:J = 0: FOR I = 0 TO 12
  1
1135 IF I > 121 THEN 1170
1140 A = I * 2 + 12 + BU: IF PEEK (A) = 0 THEN
  I = I + 1: GOTO 1135
1155 J = J + 1:A(J) = PEEK (A):B(J) = PEEK
  (A + 1)
1170 NEXT :U = J: PRINT : PRINT CHR$ (4)"P
  R#":SL: FOR J = 1 TO U: POKE 780,A(J): POKE
  781,B(J): CALL 768: FOR I = 0 TO 255:A =
  BU + I: IF HE THEN H = PEEK (A): GOSUB
  900: PRINT A$: GOTO 1230
1220 PRINT CHR$ (PEEK (A)):
1230 NEXT : NEXT : PRINT : PRINT CHR$ (4)"
  PR#": RETURN
2000 POKE 780,0: FOR C = 11 TO 4 STEP - 2:
  POKE 781,C: POKE 785,64: CALL 768: POKE
  781,C - 1: POKE 785,65: CALL 768:EN = B
  U + 26
2030 SB = PEEK (EN) + PEEK (EN + 1) * 256:
  EB = PEEK (EN + 2) + PEEK (EN + 3) *
  256:LG = PEEK (EN + 6):E$ = "": IF LG =
  0 THEN 2100
2060 FOR I = EN + 7 TO EN + 7 + LG - 1:E$ =
  E$ + CHR$ (PEEK (I)): NEXT : IF CF THEN
  PRINT E$: GOTO 2100
2090 IF A$ = E$ THEN 2200
2100 EN = EN + 26: IF EN < BU + 512 - 26 THEN
  2030
2110 NEXT : GOTO 1085
2200 PRINT : PRINT CHR$ (4)"PR#":SL:T = INT
  (SB / 8):S = SB - T * 8:T1 = INT (EB /
  8):S1 = EB - T1 * 8:S2 = S1:T1 = T1 - 1
  : FOR I = T TO T1:S3 = S1: IF T1 > I THEN
  S3 = 7
2250 FOR J = S2 TO S3: POKE 785,64: POKE 78
  0,I: POKE 781,TS(0,J): CALL 768:GOSUB
  2470: POKE 780,I: POKE 781,TS(1,J): CALL
  768:GOSUB 2470: NEXT :S2 = 0: NEXT : PRINT
  : PRINT CHR$ (4)"PR#": RETURN
2470 FOR K = 0 TO 255:A = BU + K: IF HE THEN
  H = PEEK (A): GOSUB 900: PRINT A$: GOTO
  2490
2485 PRINT CHR$ (PEEK (A)):
2490 NEXT : RETURN
9000 FOR I = 768 TO 805
9010 READ A: POKE I,A: NEXT
9011 FOR I = 0 TO 7: FOR J = 0 TO 1: READ T
  S(J,I): NEXT J,I
9015 RETURN
9020 DATA 169,3,160,8,32,217,3,96,1,96
9030 DATA 1,0,17,15,30,3,0,64,0,0
9040 DATA 1,0,254,96,1,0,0,0,0,0
9050 DATA 0,1,239,216,0,0,0,0
9060 DATA 0,14,13,12,11,10,9,8,7,6,5,4,3,2,
  1,15

```

**MICRO**<sup>TM</sup>**Apple Reviews**

**Product Name:** Ultra ROM Board/Editor  
**Equip. req'd:** Apple II  
**Price:** \$190.00  
**Manufacturer:** Hollywood Hardware  
 6842 Valjean Ave.  
 Van Nuys, CA 91406

**Description:** A plug-in ROM board with Neil Konzen's GPLE included with 25 ampersand utilities for an on-line editor/utility package. The Global Program Line Editor is a handy set of line editing commands and is available at any time, even with a program already loaded. The utilities include switching in other "&" commands, BLOAD information, control character display, free sectors, line finder, HIMEM and LOMEM settings, graphics screen commands without clearing screen, IF, THEN, ELSE structures, program restore (not new), PRINT USING, memory search, clear end-of-line and -page, help and macro definitions, for single key entry.

**Pluses:** The program is always waiting to be called. If you forget to load a line editor while working on a program, then you have to save, load the editor and reload the program. With Ultra ROM, a PR# <slot > command will activate the editor, program intact. If you program a lot and haven't used a line editor, get one right away.

**Minuses:** The "&" additions will only run on a similar system. (A new runtime package is being included for transportability.)

**Documentation:** A 50-page manual clearly explains how the programs work and how to manage your own vectors.

**Skill level required:** Some programming experience is necessary for full use.

**Reviewer:** Phil Daley

**Product Name:** Robographics CAD-1  
**Equip. req'd:** Apple II  
**Price:** \$1095.00  
**Manufacturer:** ROBO Graphics  
 125 Pheasant Run, Suite 2B  
 Newton, PA 18940

**Description:** An extremely sophisticated computer-aided graphics and drafting package for the Apple which has functions, speed and accuracy previously available only on expensive CAD systems. The basic system includes 4 disks, manual, interface module (a copy protection device) and a precision controller much more accurate and versatile than a joystick. It has such features as zoom, pan, angle locks, grid locks, scale drawing, move, find, exchange, line color and type, text entry and more. Pictures

can be stored on a library disk with unique picture labeling and retrieval system. Optional equipment includes dot-matrix printer, plotter, color printer, and digitizer.

**Pluses:** The system is menu driven and easy to become acquainted with. Scale drawing is accurate and easy to do. Zoom works at many levels of nesting, (greater than 1 part in a billion) giving effectively unlimited screen resolution. Picture complexity is only limited by space on disk. This system has to be seen in operation to appreciate its power: especially its ability to produce highly detailed technical drawings.

**Minuses:** On complex pictures this system can be slow. Redrawing a picture on screen can take several minutes.

**Documentation:** An easy to read and well indexed manual answers all questions on operation.

**Skill level required:** Some drafting experience will help get the full benefit of all the sophisticated features.

**Reviewer:** Phil Daley

**Product Name:** Cdex Training for VisiCalc  
**Equip. req'd:** Apple II +  
**Price:** \$49.95  
**Manufacturer:** Cdex Corporation  
 5050 El Camino Real, Suite 200  
 Los Altos, CA 94022  
**Developer:** Dr. Steven C. Brandt

**Description:** A real bargain. A program to teach you how to use VisiCalc and to use as reference. 2 disks lead step by step in major concepts and commands of VisiCalc; have review questions, hints, positive reinforcements. 3rd disk is quick reference of commands. Manual supplements material with exercises and reference.

**Pluses:** Very interactive; easy to use. A professional, top-quality package.

**Minuses:** Disk lessons do not cover all commands, such as window and title commands, but are covered in the reference disk.

**Documentation:** Well-written, indexed manual contains command reference, examples and exercises.

**Skill level required:** Anyone interested in learning about VisiCalc. Very little computer experience needed.

**Reviewer:** Mary Gasiorowski

(Continued on next page)

**Reviews** (continued)

**Product Name:** KoalaPad Touch Tablet  
**Equip. req'd:** Apple II  
**Price:** \$129.95  
**Manufacturer:** Koala Technologies  
 253 Martens Ave.  
 Mt. View, CA 94040

**Description:** A graphics tablet operating from the game controller port with extreme smoothness and precision. The 4 x 4 inch active surface can be activated with finger or stylus. It includes two controller buttons.

**Pluses:** This product is a great refinement over a joystick. It is much easier and more natural to control than paddles or conventional joysticks. I immediately improved my previous high scores on every game I tried it on. Programming is identical to paddle programming.

**Minuses:** The KoalaPad Touch Tablet does not have self-centering such as a joystick has, and removing your finger from the tablet may result in untimely moves during the progress of a game.

**Documentation:** A very complete, clear and well written booklet is included with the tablet.

**Skill level required:** No prior skill needed.

**Reviewed:** Phil Daley

**Product Name:** Personal Finance Manager  
**Equip. req'd:** Apple II+, or Apple II with Applesoft Firmware Card or Language System; 48K RAM; and one disk drive (DOS 3.3).  
**Price:** \$75.00  
**Manufacturer:** Apple Computer Inc.  
 10260 Badley Drive  
 Cupertino, CA 95014

**Description:** A financial program that allows you to budget twenty-four separate accounts which you define. Also available are credit card accounts, and checkbook reconciliation. Defaults make date input and editing a snap. PFM prints out any display you wish and will also move each year's records to another disk for long-term storage.

**Pluses:** Ample room for the average person, PFM has superb error-handling checks and messages to guide you along. The monthly/yearly updates are helpful and are backed up with a bar graph.

**Minuses:** You can't track income which would give you a better income vs. expenses picture. Having to continually load modules from disk slows PFM's speed. Not being able to make financial projections will annoy some of you.

**Documentation:** An attractive and concise booklet is provided with the master disk and backup.

**Skill level required:** Any person able to turn the computer on and follow directions.

**Reviewer:** Mike Cherry

**MICRO**



<b>SOFTWARE ENHANCEMENT SYSTEM, APB-102</b>	<b>\$189.00</b>
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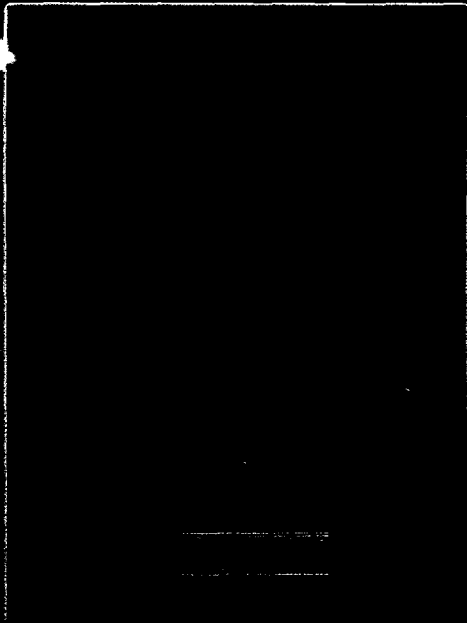


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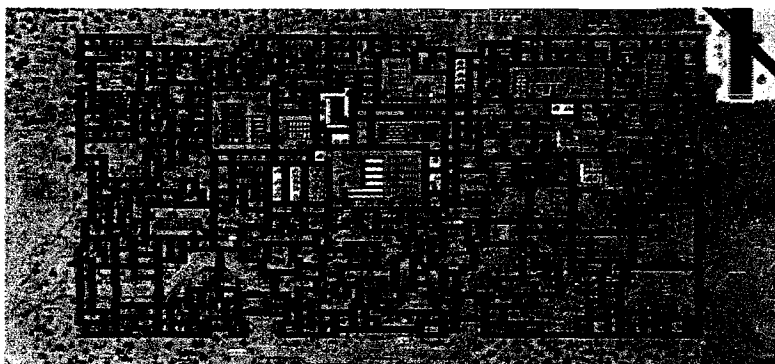
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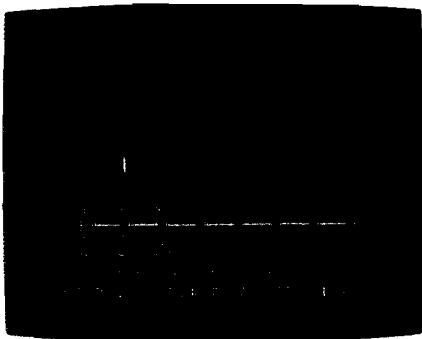
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# MICRO CALC

by Phil Daley

## Typing in the Listing

The assembly listing is for reference only; the data statements for poking the machine language are contained in the BASIC program (Listing 1). After seeing how the program works, the GOSUB 1250 in line 140 can be eliminated to remove the initial screen each time the program runs.

### Features:

- ✓ 15 working lines
- ✓ support of disk or tape files
- ✓ optional zeroing of user tables
- ✓ multiple statement support
- ✓ display of disk or tape file name

## Operating Instructions

- @ performs calculations
- CLEAR zeros user variable
- & enters file mode
- Shift CLEAR clears screen
- right arrow moves up one line

## Using the Internal TIMER

The Color Computer has a special variable TIMER which increments once every 1/60 second. You can use this timer on a Micro Calc screen to compare the speed of BASIC functions. Following is a screen that demonstrates this point:

```
A = 5.3507
T = TIMER
B = A ^ 2
U = TIMER - T
U?
T = TIMER
B = A * A
U = TIMER - T
U?
```

You may be surprised by the results of this comparison between using exponentiation and simple multiplication to square a number. Other comparisons you may wish to try are:

- using a number vs. a variable in calculation
- the SQR() function vs. raising to the .5 power
- SIN() vs. COS()

## Listing 1

```
10 *MICROCALC for the TRS80CoCo
20 *By P. Daley
30 *Version 1.0 : 10/14/83
40 *Copyright (C) 1983
50 *by MICRO Ink
60 *10 Northern Blvd.
70 *Amherst, NH 03031
80 *PRETEND IT'S A 16K MACHINE
90 *AND SAVE A FEW BYTES FOR M/L
100 CLEAR1000,16282
110 GOSUB420: GOSUB1190
120 B1=32
130 DEF USR0=16283: CLS2
140 DIMB$(15): GOSUB1250
150 C$=STRING$(32,159)
160 GOTO1150
170 PRINT032*X1,B$(X1);CHR$(B1);LEFT$(C$,30-LEN(B$(X1)));
180 RETURN
190 X1=0:Y1=0
200 GOSUB170
210 A$=INKEY$
220 IFA$=""THEN210
230 IFA$=""THENB1=32:GOSUB170:GOTO490
240 IFA$=CHR$(12)THENGOSUB1230:GOTO210
250 IFA$=CHR$(92)THENFORI1=0TO14:B$(I1)=""NEXT:
    B1=32:GOTO1150
260 IFASC(A$)>39ANDASC(A$)<96THEN340
270 B1=32:GOSUB170
280 IFA$=CHR$(13)THENX1=X1+1:IFX1>14THENX1=0
290 IFA$=CHR$(8)ANDY1=0THENE$(X1)=LEFT$(B$(X1),
    LEN(B$(X1))-1):Y1=Y1-1
300 IFA$=CHR$(9)THENX1=X1-1:IFX1<0THENX1=14
310 IFA$=CHR$(10)THENX1=X1+1:IFX1>14THENX1=0
320 IFA$="%"THEN990
330 GOTO380
340 Y1=Y1+1:IFY1>29THENB1=32:GOSUB170:X1=X1+1:Y1=0
350 IFLEN(B$(X1))>29THENX1=X1+1:GOTO370
360 B$(X1)=B$(X1)+A$
370 IFX1>14THENX1=0
380 Y1=LEN(B$(X1)): B1=95
390 IFMID$(B$(X1),2,1)=""?THENB$(X1)=LEFT$(B$(X1),2)
400 GOSUB170
410 GOTO210
420 *M/L ROUTINE TO EVALUATE
430 *EXPRESSION AND RETURN
440 FORI1=16283TO16283+26
450 READA1:POKEI1,A1:NEXT:RETURN
460 DATA 158,166,52,16,142,2,221,159,166
470 DATA 189,184,33,142,2,220,159,166,166,132
480 DATA 189,173,198,53,16,159,166,57
490 *ROUTINE TO POKE EXPRESSIONS
500 *SET UP VARIABLES AND PRINT
510 FORI1=0TO14: CT=0: BUF=732
520 IFLEN(B$(I1))<2THEN 660
530 IFMID$(B$(I1),2,1)<>"?THEN610
540 FORJ1=1TOLEN(B$(I1))
550 IFMID$(B$(I1),J1,1)=""?THEN FLAG=1:GOSUB580:GOTO570
560 POKEBUF+J1,ASC(MID$(B$(I1),J1,1)): CT=CT+1
570 NEXT
580 POKEBUF+J1,13: BUF=BUF-(CT+1)
590 CT=0: Z1=USR0(Z1)
600 IF FLAG=1 THEN FLAG=0: RETURN
610 IFMID$(B$(I1),2,1)<>"?THEN660
620 KK=ASC(LEFT$(B$(I1),1))-64
630 GOSUB700
640 B$(I1)=LEFT$(B$(I1),2)+STR$(Z1)
650 X1=11:B1=32:GOSUB170
660 NEXT
670 X1=0:B1=95:GOSUB170
```

(Continued on next page)

**Listing 1 (continued)**

```

650 GOTO210
690 KK=ASC(LEFT$(B$(I1),1))-64
700 ON KK GOTO 720,730,740,750,760,770,780,790,800,810,
      820,830,840,850,860,870,880,890,900,910,920,930,940,
      950,960,970
710 RETURN
720 Z1=A:RETURN
730 Z1=B:RETURN
740 Z1=C:RETURN
750 Z1=D:RETURN
760 Z1=E:RETURN
770 Z1=F:RETURN
780 Z1=G:RETURN
790 Z1=H:RETURN
800 Z1=I:RETURN
810 Z1=J:RETURN
820 Z1=K:RETURN
830 Z1=L:RETURN
840 Z1=M:RETURN
850 Z1=N:RETURN
860 Z1=O:RETURN
870 Z1=P:RETURN
880 Z1=Q:RETURN
890 Z1=R:RETURN
900 Z1=S:RETURN
910 Z1=T:RETURN
920 Z1=U:RETURN
930 Z1=V:RETURN
940 Z1=W:RETURN
950 Z1=X:RETURN
960 Z1=Y:RETURN
970 Z1=Z:RETURN
980 RETURN
990 CLS:PRINT@64,"SAVE OR LOAD?"
1000 INPUT#
1010 PRINT:INPUT"FILENAME: ";F#
1020 IFLEN(F#)=0THENF#="MICRO"
1030 F#="F#"+".CAL"
1040 B$(I1)=F#
1050 IFLEFT$(A#,1)="L"THEN1110
1060 OPEN "O",#TD,F#
1070 FORI1=0TO14
1080 WRITE #TD,B$(I1)
1090 NEXT:CLOSE #TD
1100 GOTO1150
1110 OPEN "I",#TD,F#
1120 FORI1=0TO14

```

**I**

**H**

```

1130 INPUT #TD,B$(I1)
1140 NEXT:CLOSE #TD
1150 CLS2:FORX1=0TO15
1160 GOSUB170
1170 NEXT:B1=95
1180 GOTO190
1190 CLS:PRINT"TAPE OR DISK SYSTEM: ";:INPUT#
1200 IF LEFT$(A#,1)="D"THEN TD=1 ELSE TD=-1
1210 RETURN
1220 D=99
1230 A=0:B=0:C=0:D=0:E=0:F=0:G=0:H=0:I=0:J=0:K=0:L=0:M=0:
      N=0:O=0:P=0:Q=0:R=0:S=0:T=0:U=0:V=0:W=0:X=0:Y=0:Z=0
1240 RETURN
1250 FORI1=0TO14:READB$(I1):NEXT:RETURN
1260 DATA=8000,,M=45,,I=11.9,,I=1/1200,,D=(1-I1+1)*M/I,
1270 DATA=A/D,,P=INT(P*100+.5)/100,,P?

```

**A**

**M**

**Listing 2**

```

# MICRO CALC
# Modified for TRS 80C
# by P. Daley
# October 14, 1983

# CONSTANTS

00A6 CHRPTR EQU $A6
02DC STRING EQU $2DC
ADC6 COMMAND EQU $ADC6
B021 TOKEN EQU $B021

9E A6 LDX CHRPTR Get current pointer
34 10 FSHS X Save it
8E 02DD LDX #STRING+1 Load pointer to input buffer
9F A6 STX CHRPTR Set pointer
BD B021 JSR TOKEN Tokenize string
8E 02DC LDX #STRING Reset pointer to tokenized
9F A6 STX CHRPTR string and store it
A6 B4 LDA X Get first character
BD ADC6 JSR COMMAND Execute immediate mode
35 10 PULS X Set old pointer and
9F A6 STX CHRPTR restore it
39 RTS Return

END START

```

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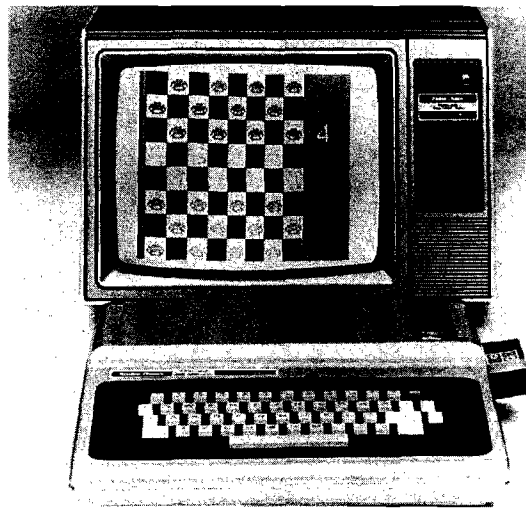
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# Radio Shack Color Computer Memory Map



[All Numbers in Hex]

### Overview

0000-03FF	Ram used by BASIC Interpreter
0400-05FF	Video Display (May be moved)
0600-0FFF	RAM for user program
1000-3FFF	Additional RAM in 16K system
4000-7FFF	Additional RAM in 32K system
8000-9FFF	Extended BASIC ROM
A000-BFFF	Basic Interpreter ROM
C000-FE FF	Cartridge ROM
FF00-FFFF	I/O and Control

### Extended

0003	General Counter
0006	String Flag
0007	Flag if Garbage Collected
0019	Start of User RAM
0019-001A	BASIC Program Begin
001B-001C	Pointer to Top of Program/Begin Variables
001D-001E	Pointer to Top of Variables/Start of Arrays
001F-0020	Pointer to End of Arrays/Start of Available Memory
0021-0022	Top of Stack/Start of String Pool
0023-0024	Start of Used Area of String Pool
0025-0026	Pointer to BASIC Memory Limit
0027-0028	End of String Pool/Start of User Space
0033-0034	Pointer to Current Data Read Position
0037-0038	Current Variable Name
0041	4 Bytes Used by Tokenize
0041-0048	Start and End Address of Block Move
0041	Highest Address to Move to
0043	Highest Address to Move
0045	Lowest Address Moved to
0047	Lowest Address to Move
0047	Highest String Found
004B	Address of Descriptor of Highest String Found
004F-0054	Floating Point Accumulator #1 (6 bytes)
0056	String Length
005C-0061	Floating Point Accumulator #2 (6 bytes)

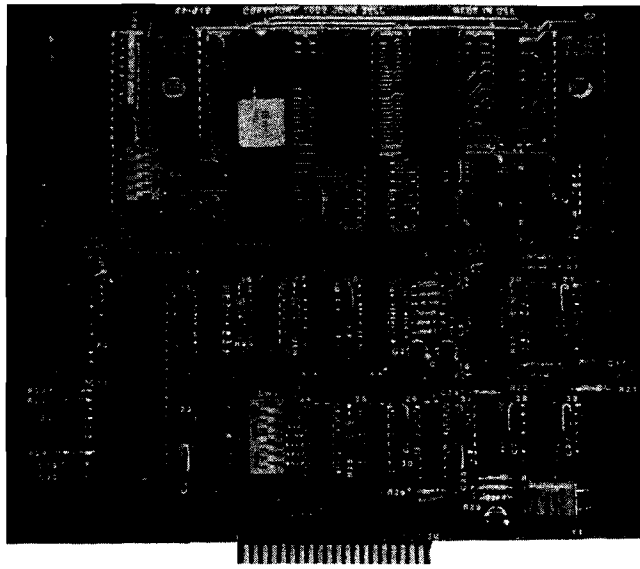
0062	Sign Comparison
0063	Extended Precision Byte
0068-0069	Current Program Line
006C	Current Column Position
006F	Device Number for Output Character (0 = Screen, \$FE = Printer, \$FF = Tape, 1-16 = Disk BASIC File#)
0070	EOF on Tape File Flag
0071	Reset Flag = \$55 for Warmstart
0072-0073	Restart Pointer (contains \$80C0-BASIC Warmstart)
0074-0075	Pointer to End of Memory
0078	File Mode (0 = None, 1 = Input, 2 = Output)
0079	Tape Working Buffer Length
007A-007B	Tape Working Buffer Pointer
007C	Tape File Block Type (0 = Header, 1 = Data, \$FF = EOF)
007D	Number of Data Bytes in Cassette I/O Block
007E-007F	Program End Address 1 after a CLOADM
0080	Checksum
0081	Cassette Error #
0082	General Counter
0083	Pulse Width Count
0084	Rise/Fall Flag
0085	Last Sine Value
0087	Last Key Entered
0088-0089	Pointer to Current Cursor Position
008A-008B	Serial Read # of Tries
008C	Sound Frequency
008D-008E	Duration of Sound
008F	Start of Area Downloaded from ROM
0092	Controls Length of Unmodulated Carrier Preceding Cassette I/O
0094	Cursor Color
0095-0096	High and Low bytes of Baud Rate Code (Normally \$0057)
0097-0098	Carriage Return Delay (Normally \$0001)
0099	Comma Field Width (Normally \$10)
009A	Last Comma Field (Normally \$70)
009B	Printer Line Width (Normally \$84)
009C	Affects positions of Vars. Line-printed in Comma Fields (\$00)

009D-009E	Transfer Address after CLOADM	014E-014F	Address for USR8
009F	Start of get next character subroutine	0150-0151	Address for USR9
00A5	Start of get same character subroutine	0152-0159	Keyboard Rollover Table
00A6	Next Character Pointer	015A-015D	Joystick Readings
00A8-00AA	Jump Vector to Print OK	015A	Left Joystick Up/Down
00AB-00AE	Extended Product Area	015B	Left Joystick Left/Right
00AF	Trace Flag	015C	Right Joystick Up/Down
00B5	Current Color	015D	Right Joystick Right/Left
00B6	Current PMODE	015E-0160	Open Device Hook Called at \$A5F6/Set to \$C426 by Disk
00B7-00B8	End of Screen1	0161-0163	Device Number Check Called at \$A5B9/Set to \$C838 by Disk
00B9	Number of Bytes per Line	0164-0166	Return Device Parameters Called at \$A35F/Set to \$C843 by Disk
00BA-00BB	Address of Graphics Page	0167-0169	Character Output Called at \$A282/Set to \$8273 by Extended/Set to \$CB4A by Disk
00BC	\$E = Disk system,\$6 = No disk	016A-016C	Character Input Called at \$A176/Set to \$BCF1 by Extended/Set to \$C58F by Disk
00BD	X1	016D-016F	Check File OPEN for Input Called at \$A3ED/Set to \$C818 by Disk
00BF	Y1	0173-0175	Close All Open Files Called at \$A426/Set to \$CA3B by Disk
00C1	Color Set 1 = 8	0176-0178	Close One File Called at \$A42D/Set to \$8286 by Extended/Set to \$CA4B by Disk
00C3	X2	0179-017B	Print Using Called at \$B918/Set to \$8E90 by Extended
00C5	Y2	017C-017E	File Item Scanner Called at \$B061/Set to \$CC5B by Disk
00D7	Temp	017F-0181	Break Key Check Called at \$A549/Set to C859 by Disk
00DB	Change Flag	0182-0184	Get Line From Keyboard Called at \$A390/Set to JMP RTS by Disk
00E6	DLOAD Baud Rate	0185-0187	Finish Loading ASCII File Called at \$A4BF/Set to \$CA36 by Disk
00E7	Input Timeout Constant	0188-018A	Check End Of File Called at \$A5CE/Set to \$C860 by Disk
00EA	Operation Code	018B-018D	Evaluate Operánd Called at \$B223/Set to \$8846 by Extended/Set to \$CDF6 by Disk
00EB	Drive Number	018E-0190	User Error Called at \$AC46/Set to JMP RTS by Disk
00EC	Track	0191-0193	Error Called at \$AC49/Set to \$88F0 by Extended/Set to \$C24D by Disk
00ED	Sector	0194-0196	Run Called at \$AE75/Set to \$829C by Extended/Set to \$C990 by Disk
00EE	Buffer Address	0197-0199	Hex & Octal Called at \$BD22/Set to \$87E5 by Extended
00F0	Status Returned	019A-019C	Execute Line Called at \$AD9E/Set to \$82B9 by Extended
0100-0102	Software Interrupt 3 Called by Vector at \$FFF2	019D-019F	Graphics Address Called at \$A8C4
0103-0104	Software Interrupt 2 Called by Vector at \$FFF4	01A0-01A2	CLS,GET,PUT etc. Called at \$A910,\$975C,\$8AFA,\$8162 Set to \$C29A by Disk
0105-0108	Software Interrupt 1 Called by Vector at \$FFFA	01A3-01A5	Tokenize Called at \$B821/Set to \$8304 by Extended
0109-010B	Non-Maskable Interrupt Called by Vector at \$FFFC Set to \$D7AE by Disk	8000-9FFF	Extended BASIC ROM
010C-010E	Interrupt Request Called by Vector at \$FFF8 Set to \$A9B3/Set to \$894C by Extended/Set to \$D7BC by Disk	01D1	Tape File Length
010F-0111	Fast Interrupt Vector Called by Vector at \$FFF6/Set to \$A0F6	01D2-01D9	Tape File Name
0112-0113	High and low bytes of TIMER	01DA-02D8	Cassette Buffer
0116-0117	Seed for RND Function	01DA-01E1	CLOADM File Name
011A	Shift Lock Flag	01E5-01E6	EXEC Address from Tape
011C	Keyboard Delay Constant		
011D-011F	Jump vector to \$8489-Print OK		
0120-013C	Token Table Directory[Byte 1 = # of Keywords,Byte 2,3 = Address of Table, Byte 4,5 = Address of Subroutines)		
0120-0124	BASIC Commands		
0125-0129	BASIC Functions		
012A-012E	Extended BASIC Commands		
012F-0133	Extended BASIC Functions		
0134-0138	Disk BASIC Commands		
0139-013C	Disk BASIC Functions		
013E-013F	Address for USR0		
0140-0141	Address for USR1		
0142-0143	Address for USR2		
0144-0145	Address for USR3		
0146-0147	Address for USR4		
0148-0149	Address for USR5		
014A-014B	Address for USR6		
014C-014D	Address for USR7		



# VIDEO TERMINAL BOARD 82-018

This is a complete stand alone Video Terminal board. All that is needed besides this board is a parallel ASCII keyboard, standard NTSC monitor, and a power supply. It displays 80 columns by 25 lines of UPPER and lower case characters. Data is transferred by RS232 at rates of 110 baud to 9600 baud — switch selectable. The UART is controlled (parity etc.) by a 5 pos. dip switch.

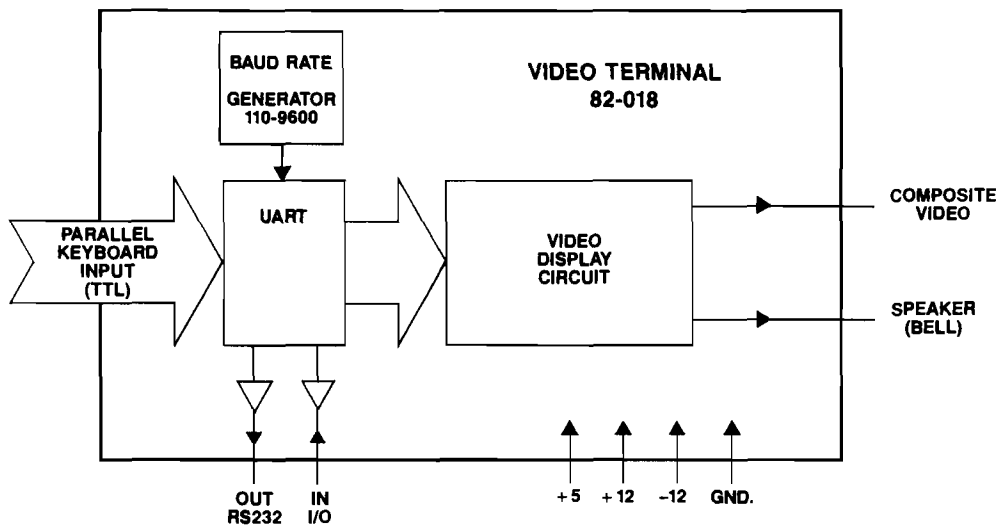


Complete source listing is included in the documentation. Both the character generator and the CRT program are in 2716 EPROMS to allow easy modification to your needs.

This board uses a 6502 Microprocessor and a 6545-1 CRT controller. The 6502 runs during the horz. and vert. blanking (45% of the time). The serial input port is interrupt driven. A 1500 character silo is used to store data until the 6502 can display it.

## Features

- 6502 Microprocessor
- 6545-1 CRT controller
- 2716 EPROM char. gen.
- 2716 EPROM program
- 4K RAM (6116)
- 2K EPROM 2716
- RS232 I/O for direct connection to computer or modem.
- 80 columns x 25 line display
- Size 6.2" x 7.2"
- Output for speaker (bell)
- Power +5 700Ma.  
+12 50Ma.  
-12 50Ma.



This board is available assembled and tested, or bare board with the two EPROMS and crystal.

Assembled and tested	#82-018A	\$199.95
Bare board with EPROMS and crystal	#82-018B	\$ 89.95

Both versions come with complete documentation.



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#249

01E7-01E8 Load Address from Tape  
 02DC Contains token for first keyword in BASIC Statement  
 02DD-03DC Console I/O Buffer  
 0400-05FF Lo-res screen  
 0600-35FF Possible Graphic Screens  
 0600 Bottom of program area/No Disk  
 0600-06FF Disk Buffer  
 0700-07FF Disk Buffer  
 0800-0927 Drive Table  
 097E Table of Current Tracks  
 0982 NMI in use flag  
 0983 NMI JMP  
 0985 Motor shutoff counter  
 0986 Current latch data  
 0C00 Program Start/Disk System  
 0FFF Top of memory (4K)  
 3FFF Top of memory (16K)  
 7FFF Top of memory (32K)  
 8000-9FFF Extended BASIC ROM  
 807F Cold Start to BASIC without size Search and Workspace init. Resets pointers to Start of BASIC Program  
 80C0 Warmstart to BASIC. Does not Reset Pointers to Start of BASIC Prog  
 8183-81EF Extended Command Token Table  
 81F0-821D Subroutine Entry Addresses  
 821E-8256 Extended Function Token Table  
 8257-8272 Subroutine Entry Addresses  
 82B9 Break or Stop Routine  
 82BB Extended interpret loop  
 8378 COSine  
 8381 TANgent  
 83B0 ArcTaNgent  
 8446 LOG  
 8480 SQUare Root  
 84F2 EXPOntial  
 8524 FIX  
 8533 EDIT  
 86A7 TRace ON  
 86A8 TRace OFF  
 86AC POSition  
 86BE VARiable PoinTeR  
 874E STRING\$  
 877E INSTRing  
 8871 DEFine  
 8968 TIMER  
 8970 DElete  
 8A09 RENUMber  
 8BDD HEX\$  
 8C18 DownLOAD  
 8DBC Input Serial Character  
 8E06 Output Serial Character  
 928F Find Byte/Bit Routine  
 92A6 Byte/Bit; PMODES 0,2,4  
 92C2 Byte/Bit; PMODES 1,3  
 92DD Bit Tables  
 9339 PPOINT  
 9361 PSET  
 9365 PRESET  
 93BB LINE  
 9444 Draw Horizontal Line  
 946C Draw Vertical Line

94A1 Draw Line  
 94E2 The Draw Line Loop  
 9506 Move Up, Down, Left, Right Routines  
 9532 PCLS  
 9546 COLOR  
 9621 PMODE  
 9670 SCREEN  
 968B PCLEAR  
 9710 Compare Two Points  
 9723 PCOPY  
 9755 GET  
 9758 PUT  
 98EC PAINT  
 9A22 PLAY  
 9CB6 DRAW  
 9E9D CIRCLE  
 A000-BFFF BASIC ROM  
 A000-A001 Address of Check Keyboard  
 A002-A003 Address of Character Out  
 A004-A005 Address of Cassette Read On  
 A006-A007 Address of Block In  
 A008-A009 Address of Block Out  
 A00A-A00B Address of Joystick In  
 A00C-A00D Address of Header Out  
 A00E Secondary Reset  
 A027 Primary Reset  
 A06E Hardstart (After Reset)  
 A0A6 Check for Disk ROM  
 A0CB Check for Extended ROM  
 A0D7 Print Version  
 A0E8 Softstart (After Reset)  
 A0F6 FIRQ Entry (ROM Pack Check)  
 A10D Start of Area Downloaded to RAM at \$8F  
 A129 Start of Area Downloaded to RAM at \$10C  
 A171 Input Character, Bit 7 Clear  
 A176 Input Character  
 A199 Blink Cursor Color  
 A1B1 Wait for Keypress and Read Kybd; Char Returned in A Register  
 A1C1 Check Keyboard and Get Key if pressed; Z=1,A=0 if no key Z=0,A=key, B and X Preserved  
 A26E Table of Codes for non-alpha keys  
 A282 Output Character to Device Specified by \$6F, All But CC Preserved  
 A2BF Output Character in A to Printer (RS232)  
 A30A Output Character in A to Screen  
 A390 Input Line from Keyboard into Buffer at \$02DD; Return X\$02DC; Zero byte at End of Buffer  
 A416 CLOSE  
 A44C CSAVE  
 A46C Perform CSAVEM Function; Requires Start of Memory Block in \$19-A0 and in \$01E7-8, Transfer Address in \$01E5-6, and File Name in \$01D2-9. Enter with A=2 and X=0.  
 A498 CLOAD  
 A4FE CLOADM  
 A53E EXEC

A564	INKEY\$		
A59A	Transfer Block		Address, \$45-6 is Destination Bottom
A5CE	EOF		Address after Move, \$47-8 is Source
A5EC	SKIPF		Bottom Address
A5F6	OPEN	AC46	Error Handler
A629	Open Tape File	AC73	Idle Loop
A681	Find Filename	AD17	NEW (Clear Memory)
A6FE	Blink Screen Corner	AD19	Execute NEW
A701	READ Block from Tape	AD47	FOR
A70B	Read a Block from Cassette; Must be On and In Bit Sync. \$7C Contains File Block Type:0 = File Header, 1 = data, \$FF = EOF. \$7D Contains Number of Data Bytes in File (0-\$FF). Z = 1, A = 0 if no Errors, Z = 0, A = 1 if Checksum Error, Z = 0, A = 2 if Memory Error. X = Buffer Start Block Length if no Error, X Points to Beyond Bad Address if Error. U and Y Preserved	AD9E	Interpret Loop
A77C	Start Cassette and Get Into Bit Sync for Reading. U and Y Preserved, FIRQ and IRQ Masked.	ADC6	Execute line
A7BD	MOTOR	ADE4	RESTORE
A7D8	Turn Cassette On and Write Leader	ADEB	Check for Break or Pause
A7E5	Write Tape File	AE02	END
A7E9	Turn Off Motor	AE09	STOP
A7F4	Write Block to Cassette; Tape to Speed and Leader Written, \$7E = Buffer Address, \$7C = Block Type, \$7D = Number of Data Bytes, X = Buffer Address Data Bytes, All Registers Modified	AE30	CONTINUE
A85C	Sine Table for Cassette Out	AE41	CLEAR
A880	SET	AE75	RUN
A8B1	RESET	AE86	GO
A8F5	POINT	AE92	GOSUB
A910	CLS	AEA4	GOTO
A928	Clear Screen and Home Cursor	AEC0	RETURN
A937	Print Copyright (CLS 9)	AEE0	DATA
A94B	SOUND	AEE3	REM or '
A956	Generate Sound	AEE8	ELSE
A992	AUDIO	AF14	IF
A9B3	Interrupt Processor (60 Hz Counter)	AF42	ON
A9C6	JOYSTICK	AF67	Get Unsigned Integer
A9DE	Read and Store Joystick Values; Left:Up/Down is \$15A,Rt/Lft is \$15B; Right:Up/Down is \$15C,Rt/ Lft is \$15D. Y is Preserved	AF89	LET
AA29	Function Address Table	AFF5	INPUT
AA51	Operation Table for +, -, *, /, , AND,OR (3 bytes each-Addresses and Precedence Values)	B046	READ
AA66	Command Name Table	B0F8	NEXT
AB1A	Function Name Table	B156	Get Expression
AB67	Command Address Table	B1CB	Another Entry in Operation Table
ABAF	Error Code Table	B223	Get Operand
ABE1	Text Strings	B290	Execute Functions
ABF9	Search Stack for GOSUB or FOR	B2D4	AND/OR Operations
AC1E	Open up space in memory	B2F4	Relational Operations
AC20	Move Block of Memory Starting at Top; \$41-2 is Destination Top Address, \$43-4 is Source Top	B34E	DIMENSION
		B38F	Variable Creation
		B3E4	Evaluate Integer Expression
		B3ED	Convert Number in FPAC into 16-bit Two's Complement Integer Left in D Register; Overflow, return to BASIC if > +32767 or < -32768
		B4EE	MEM
		B4FD	STR\$
		B518	Get String
		B56D	Allocate string routine
		B591	Garbage Collect
		B5D8	Process one descriptor
		B5EF	Compact one string
		B61	LEN
		B68C	CHR\$
		B6A0	ASC
		B6AB	LEFT\$
		B6C8	RIGHT\$
		B6CF	MID\$
		B716	VAL
		B750	PEEK
		B757	POKE
		B75E	LLIST Command
		B764	LIST Command
		B7C2	Untokenize

B7E6 Untokenize one token  
 B821 Tokenize  
 B892 Tokenize one word  
 B8F7 PRINT  
 B97E TAB  
 B99C Print Text String  
 B9AC Print a Space  
 B9B4 Start of Floating Point Routines-  
 Rounding  
 B9B9 Subtract from FPAC1  
 B9C2 Add to FPAC1  
 BA79 Two's Complement FPAC1  
 BAC5 Constant 1.0  
 BACA Multiply  
 BB2F Move [X] to FPAC2  
 BB7D Constant 10.0  
 BB91 Divide  
 BC4A Move FPAC2 to FPAC1  
 BC5F Move FPAC1 to FPAC2  
 BC6D Test FPAC1 for Zero and Sign  
 BC7A SiGN  
 BC93 ABSolute value  
 BCEE INTeger  
 BD12 Convert String to Floating Point  
 BDB6 Constants 99999999.9, 99999999,  
 1E09  
 BDCC Display the Decimal Value in D  
 Register  
 BDD9 Convert FPAC1 to ASCII  
 BEC0 Constant 0.5  
 BEC5 Series of 4 Byte Constants  
 BF1F RaNDom  
 BF78 SiNe  
 BFBD Constants 2 pi, 0.25  
 BFC8 Series of 5 Byte Constants  
 BFF2 Interrupt and Reset Vectors  
 BBF2-BBF3 SWI3  
 BBF4-BBF5 SWI2  
 BBF6-BBF7 FIRQ  
 BBF8-BBF9 IRQ  
 BBFA-BBFB SWI1  
 BBFC-BBFD NMI  
 BBFE-BBFF RESET  
 C000-D7FF Disk BASIC ROM  
 C004 Address of DSKCON  
 COD4 Warm Start to Disk BASIC  
 C17F-C1DA Disk Command Token Table  
 C1DB-C200 Disk Subroutine Addresses  
 C6C2 KILL  
 C932 SAVE  
 C98B MERGE  
 C99A LOAD  
 CBCF DIRectory  
 CD1A CVN  
 CD28 MKN\$  
 CD36 LOC  
 CD5B LOF  
 CDC0 FREE  
 CDE9 DRIVE  
 CF3F RENAME  
 CF8A WRITE  
 CFE0 FIELD  
 D025 RSET

D026 LSET  
 D080 FILES  
 D146 UNLOAD  
 D175 BACKUP  
 D2CC COPY  
 D3FF DSKI\$  
 D474 DSKO\$  
 D4AB DSKINI  
 D65B VERIFY  
 D66C DSKCON  
 D6C5 Restore  
 D6DE Get Status  
 D6FD Delay 78 msec  
 D705 Read/Write sector  
 D7A2 Command Address Table  
 D7AA Bit Table for Drives  
 D7AE NMI Handler  
 D7BC IRQ Handler  
 FF00-FFFF I/O and Control  
 FF00-FF03 PIA U8  
 FF00 Bit 0-KeyBoard Row 1 and Right  
 joystick switch  
 Bit 1-KeyBoard Row 2 and Left  
 joystick switch  
 Bit 2-KeyBoard Row 3  
 Bit 3-keyboard Row 4  
 Bit 4-KeyBoard Row 5  
 Bit 5-KeyBoard Row 6  
 Bit 6-KeyBoard Row 7  
 Bit 7-Joystick comparison input  
 FF01 Bit 0-Control of the Horizontal  
 sync clock[63.5 microsec]  
 Bit 1-;interrupt input  
 ;  
 Bit 2-Normally 1 0 = Changes FF00 to data  
 direction register  
 Bit 3-SEL 1: LSB of the two analog MUX  
 select lines  
 Bit 4-1 Always  
 Bit 5-1 Always  
 Bit 6-Not used  
 Bit 7-Horizontal sync interrupt flag  
 FF02 Bit 0-KeyBoard Column 1  
 Bit 1-KeyBoard Column 2  
 Bit 2-KeyBoard Column 3  
 Bit 3-KeyBoard Column 4  
 Bit 4-KeyBoard Column 5  
 Bit 5-KeyBoard Column 6  
 Bit 6-KeyBoard Column 7  
 Bit 7-KeyBoard Column 8  
 FF03 Bit 0-Control of the field  
 ;sync clock 16.667 MS  
 Bit 1-;interrupt input  
 ;  
 Bit 2-Normally 1 0 = changes FF02 to data  
 direction register  
 Bit 3-SEL 2 MSB of the two analog MUX  
 select lines  
 Bit 4-1 Always  
 Bit 5-1 Always  
 Bit 6-Not used  
 Bit 7-Feld sync interrupt flag  
 FF20-FF23 PIA U4



HEX	DEC	COCO	DBL	DRAG	DBL	MC - 10
80	128	FOR	SGN	FOR	SGN	FOR
81	129	GO	INT	GO	INT	GOTO
82	130	REM	ABS	REM	ABS	GOSUB
83	131	'	USR	'	POS	REM
84	132	ELSE	RND	ELSE	RND	IF
85	133	IF	SIN	IF	SQR	DATA
86	134	DATA	PEEK	DATA	LOG	PRINT
87	135	PRINT	LEN	PRINT	EXP	ON
88	136	ON	STR\$	ON	SIN	INPUT
89	137	INPUT	VAL	INPUT	COS	END
8A	138	END	ASC	END	TAN	NEXT
8B	139	NEXT	CHR\$	NEXT	ATN	DIM
8C	140	DIM	EOF	DIM	PEEK	READ
8D	141	READ	JOYSTK	READ	LEN	LET
8E	142	RUN	LEFT\$	LET	STR\$	RUN
8F	143	RESTORE	RIGHT\$	RUN	VAL	RESTORE
90	144	RETURN	MID\$	RESTORE	ASC	RETURN
91	145	STOP	POINT	RETURN	CHR\$	STOP
92	146	POKE	INKEY\$	STOP	EOF	POKE
93	147	CONT	MEM	POKE	JOYSTK	CONT
94	148	LIST	ATN	CONT	FIX	LIST
95	149	CLEAR	COS	LIST	HEX	CLEAR
96	150	NEW	TAN	CLEAR	LEFT\$	NEW
97	151	CLOAD	EXP	NEW	RIGHT\$	CLOAD
98	152	CSAVE	FIX	DEF	MID\$	CSAVE
99	153	OPEN	LOG	CLOAD	POINT	LLIST
9A	154	CLOSE	POS	CSAVE	INKEY\$	LPRINT
9B	155	LLIST	SQR	OPEN	MEM	SET
9C	156	SET	HEX\$	CLOSE	VARPTR	RESET
9D	157	RESET	VARPTR	LLIST	INSTR	CLS
9E	158	CLS	INSTR	SET	TIMER	SOUND
9F	159	MOTOR	TIMER	RESET	PPOINT	EXEC
A0	160	SOUND	PPOINT	CLS	STRING\$	SKIPF
A1	161	AUDIO	STRING\$	MOTOR	USR	TAB(
A2	162	EXEC	CVN	SOUND		TO
A3	163	SKIPF	FREE	AUDIO		THEN
A4	164	TAB(	LOC	EXEC		NOT
A5	165	TO	LOF	SKIPF		STEP
A6	166	SUB	MKN\$	DEL		OFF
A7	167	THEN	AS	EDIT		+
A8	168	NOT		TRON		-
A9	169	STEP		TROFF		*
AA	170	OFF		LINE		/
AB	171	+		PCLS		^
AC	172	-		PSET		AND
AD	173	*		PRESET		OR
AE	174	/		SCREEN		>
AF	175	^		PCLEAR		=
B0	176	AND		COLOR		<
B1	177	OR		CIRCLE		SGN
B2	178	>		PAINT		INT
B3	179	=		GET		ABS
B4	180	<		PUT		USR
B5	181	DEL		DRAW		RND
B6	182	EDIT		PCOPY		SQR
B7	183	TRON		PMODE		LOG
B8	184	TROFF		PLAY		EXP
B9	185	DEF		DLOAD		SIN
BA	186	LET		RENUM		COS (Continued on next page)



BB	187	LINE
BC	188	PCLS
BD	189	PSET
BE	190	PRESET
BF	191	SCREEN
C0	192	PCLEAR
C1	193	COLOR
C2	194	CIRCLE
C3	195	PAINT
C4	196	GET
C5	197	PUT
C6	198	DRAW
C7	199	PCOPY
C8	200	PMODE
C9	201	PLAY
CA	202	DLOAD
CB	203	RENUM
CC	204	FN
CD	205	USING
CE	206	DIR
CF	207	DRIVE
D0	208	FIELD
D1	209	FILES
D2	210	KILL
D3	211	LOAD
D4	212	LSET
D5	213	MERGE
D6	214	RENAME
D7	215	RSET
D8	216	SAVE
D9	217	WRITE
DA	218	VERIFY
DB	219	UNLOAD
DC	220	DSKINI
DD	221	BACKUP
DE	222	COPY
DF	223	DSKI\$
E0	224	DSKO\$

TAB(	TAN
TO	PEEK
SUB	LEN
FN	STR\$
THEN	VAL
NOT	ASC
STEP	CHR\$
OFF	LEFT\$
+	RIGHT\$
-	MID\$
*	POINT
/	VARPTR
^	INKEY\$
AND	MEM
OR	
>	
=	
<	
USING	

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Information was gleaned from the following sources in addition to personal observation:

*Color Computer News*  
*The Rainbow*  
*80 Micro*  
*John Beckett*  
*John Steiner*  
*Ralph Tenny*



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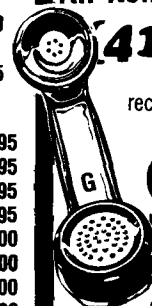
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# MICRO™

## CoCo Bits

by John Steiner



This month we will take a look at interfacing the Color Computer to a disk drive. Last month I promised a new phone number for the Dakota Database. It is 701-281-0233, and is available 24 hours a day, except for maintenance. Since mid-July, we have logged over 1000 calls, and have nearly fifty regular users. Most of the users have computers that are not CoCos. Lots of Osbornes and IBM machines check in daily, in addition to Model IIIs and several CoCos. There are even a few data terminals who make a regular appearance.

### 64K COCO

I have had a chance to check out the new 64K CoCo, and find it to be not much different from the older units. The new keyboard is nice, and is really the same style board with new keycaps. I like both keyboards very well, and prefer the new one, but those who like a longer throw on the keys should look into the Mark Data model, or one of the other professional keyboards.

The formatting problem I was working on last month has been solved. I found my drives to be out of time, just as was suggested to me. My drive zero was way off, and that was probably the majority of my initialization problems with the 1.1 ROM card. The ROM works well with either computer, and my old drives are purring again.

### Interfacing a Drive Unit

I promised a look at drive interfacing with the CoCo, so let's take a look at what is required. First of all, any standard Model III drive will work on a CoCo if it or the cable has been configured properly. This opens up a wide market for drive selection, and CoCo users can either shop for price or quality or both. My BBS has two Tandon TM-100 drives which have performed 24 hours daily for over three months with no I/O errors. On top of that, they

are quiet, far quieter than the TEC drive that Radio Shack sells. I have also used the Teac drive units from J&M, and find them to be just as quiet as the Tandon. J&M feels the Teac drive is better for CoCo than the Tandon, but as a practical matter, either seem to work fine.

The Tandon drive is a popular unit, and available from many sources, so we will look at installing these units. The first requirement is a controller board. There are several different brands available, but only two that I know of that are compatible with the Radio Shack format. These are Shack's card and the J&M controller which I have talked about earlier. The Radio Shack card is available as a replacement part, and you can order a replacement case, putting a complete controller together.

The next requirement is a drive cable, which can be ordered from Radio Shack, or you can use any external drive cable for a Model III if you configure your drives (see below). Drive cables are available either in two or four drive versions. The Color Computer drive cables are configured, which means that the cable determines which drive becomes drive zero, and which becomes drive one, etc. Many companies configure the drives, instead. Configuring the cables allows you to swap drives zero and one at any time without internal modification of the units. On the other hand, it is easier to configure the Tandon drive unit, than to configure the cable.

You can buy the configured cable from Radio Shack, or you can order an unconfigured cable from the place you get your Tandon drive units. My recommendation is to order a cable from the drive supplier that has gold plated connectors and configure your drives.

The Tandon TM-100 is a forty track single sided, double density drive. Having forty tracks is of no value to RS-DOS, which writes only to 35 tracks anyway, however if you have FLEX or

another operating system, you may be able to use those tracks by formatting your diskettes for forty track use. In FLEX, the NEWDISK command will allow you to specify number of tracks when it initializes a diskette.

Tandon sells their drives without case and power supply, so be sure to ask about this before you buy a drive unit. A bare drive can be found for around \$200, and a case and power supply will cost about \$50.00. The Dakota Database drive units are housed in a two drive case which cuts down on cost and space. If you are planning on two drives, you might look into that combination.

### Drive Configuration

Configuring a Tandon drive is easy. The configuration process allows the controller card to distinguish between drive units. On the Tandon, the configuration is done by jumpering a programmable shunt socket. This 16 pin IC socket is located toward the right rear of the circuit board near the drive connector (See figure 1). Some companies provide a DIP shunt which is sitting in the socket, while others leave you to your own devices. If you did not receive a shunt, a common staple will perform the job quite satisfactorily. Figure two is a diagram and pinout of the socket.

Configuration is easy. Make sure to connect pins 9 and 8 together. This is done on all drives. To configure a drive as drive 0, connect pins 2 and 15. Drive 1 requires connections between 3 and 14. Drive 2 connections are to pins 4 and 13, while drive 3 connections are made to pins 5 and 12. Make sure no other pins are connected, except 9 and 8 and the desired drive number pins. Figure two shows the illustration for a drive 0. Once a drive is configured it can be used as that drive with either a configured or non-configured cable. To use a drive with a configured cable, just connect it as above. Configuration can be changed at any time, should you desire to switch drives.

One last comment, there is a terminator socket (marked 2F) on the circuit board, located near the edge connector. This contains a termination resistor pack. Remove the pack from the socket on drive 0, and any intermediate drives. Leave it in the last drive on the line. I have heard con-

*(Continued on next page)*

Figure 1

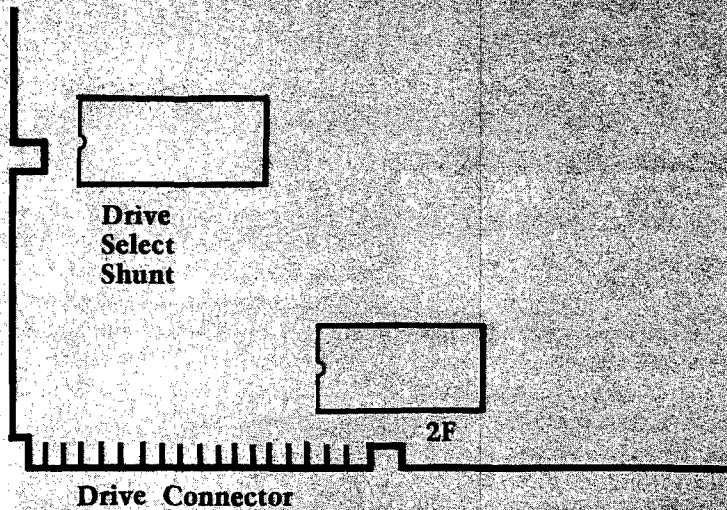
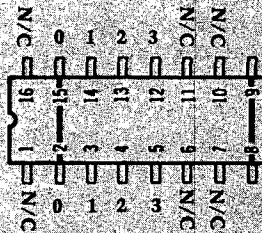


Figure 2



Listing 1

```

5 REM TAPE UTILITY
PATCH TO PROVIDE CON-
TINUOUS CASSETTE READ
7 REM BY KEN
CHRISTIANSEN
10 POKE &H0DF7,&H96
20 POKE &H0DF8,&H0
30 POKE &H0DF9,&H0B7
40 POKE &H0DFA,&H0FF
50 POKE &H0DFB,&H20
60 POKE &H0DFC,&H0BD
70 POKE &H0DFD,&H0A9
80 POKE &H0DFE,&H9E
90 POKE &H0DF7,&H39
100 POKE &H14E0,&H12
110 POKE &H14E1,&H12
120 POKE &H14E2,&H12
130 POKE &H14E3,&H12
140 POKE &H14E4,&H12
150 POKE &H14E5,&H12
160 POKE &H14E6,&H12
170 POKE &H14E7,&H0BD
180 POKE &H14E8,&H0D
190 POKE &H14E9,&H0F7
200 POKE &H1514,&H7E
210 POKE &H1515,&H14
220 POKE &H1516,&H63
230 POKE &H1288,&H7E
240 POKE &H1289,&H12
250 POKE &H128A,&H22
    
```

flicting information from different sources about this pack, with some people telling me it can be omitted from all drives. We have left it in our drive 1 without noting any adverse effects. If you have any information about this pack, drop me a line, we will pass it along.

We have installed several Tandon drive systems on both CoCo and J&M cards, and have had no problems. If you would like assistance or more information about drives, etc.; give me a call, or drop me a line. I will be glad to help. Send a stamped return envelope for a reply.

**Tape Utility**

One of the most used utilities in my software collection has been TAPE UTILITY from Spectrum Projects. The program is designed to make it easy to copy files from tape to tape, tape to disk, and vice versa. The programs most useful function is a disk to tape backup. The command BAC is used to transfer all disk files on a given disk to tape. Operation from that point is unattended, and in a little while, all disk files are on tape. There are commands to copy individual files from one media to the other, and a set of directory commands that allow printed and screen directories of both the disk and tape.

There is a tape to disk command that will copy the next tape file to disk, and present you with an option to continue or exit. The command works well, however if you want to dump an entire tape to diskette, you have to be around to prompt the computer to read in the next file. Ken Christiansen of Fargo, ND passed along the following patch that will bypass the prompt and allow the computer to continue to read in tape files. The only disadvantage to this is that when the tape is finished, you have to stop the program with the RESET key.

If you are interested in a patch that will allow the program to work with disk 1.1 ROM, drop me a line with an SASE and cassette. Ken will give you a BASIC program to patch UTIL. Spectrum Projects tells me their latest version now checks for the ROM and will operate properly with either ROM installed. Two things Tape Utility will not do are copy protected programs or copy segmented binary files. It will copy any binary file that was created using CSAVEM.

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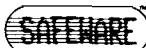
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# MICRO™ TRS-80C Reviews



**Product Name:** C.C. Calc Disk Version  
**Equip. req'd:** TRS-80 Color Computer 32K  
**Price:** \$25.00 tape or disk  
**Manufacturer:** Transformation Technologies  
 194 Lockwood Lane  
 Bloomingdale, IL 60108

**Description:** *C.C. Calc* is an electronic spreadsheet for the Color Computer. The program provides many of the spreadsheet features found on much more expensive software packages. The spread sheet is 26 x 26, which allows 676 cells. Like most spreadsheets, cells can contain labels, formulas or values. One powerful feature is the ability of a cell to contain both a label and a value. This effectively gives a larger sheet as formulas can be hidden under labels. The smaller size and format allows the personal computer user access to a power spreadsheet.

**Pluses:** One sheet can be merged with another, allowing the creation of larger effective files. Program documentation includes data file configuration, allowing you to read and write data in your own BASIC programs. Files on the disk version can be loaded with only a single key. The program is very powerful considering its low purchase price.

**Minuses:** Recalculations are not done automatically, you must recalculate each time data is changed. Because the program is in BASIC, recalculation takes a minimum of eight seconds. Parentheses are not evaluated within formulas, so care must be exercised as to proper formula layout.

**Documentation:** Seventeen pages of documentation and two sample spreadsheets accompany the software. The documentation is thorough, and allows the creation of usable spreadsheets in a short period of time. Users of Visicalc will find many similar commands and capabilities, only on a smaller scale.

**Skill level required:** Though I have never used a spreadsheet program before, I was easily tutored, and found operation of the program quite easy to learn and use.

**Reviewer:** John Steiner

---

**Product Name:** Disassembler for 6809  
**Equip. req'd:** 6809 computer w/Flex  
**Price:** \$75.00  
**Manufacturer:** Granite Computer Systems  
 Route 2 Box 445  
 Hillsboro, NH 03244  
**Author:** Gilman C. Shattuck

**Description:** A menu driven 6809 disassembler with user symbol tables. Creates source files compatible with the TSC Editor/Assembler. Output can be to the screen, printer, disk or tape. It has look-up table for Flex and Monitor references, local and global labels and expressions, and equate table for all external references. There is an option for single-step disassembly, data areas are user definable, the program is supplied on 5 or 8 inch disks or tape.

**Pluses:** The disassembler is menu driven making the use simple and direct. The program is very fast and offers many options for changing data areas, labels, equates, and output. The output listing is the same format as the TSC Assembler and the disk output can be used as input for the assembler. Input is carefully screened to eliminate mistakes.

**Minuses:** You must have the program loaded before calling the disassembler.

**Documentation:** The 12 page guide is well written, although a little brief. It describes the menu functions, gives some hints on disassembly and lists some references for more in-depth study.

**Skill level required:** The documentation assumes familiarity with 6809 machine language programming.

**Reviewer:** Phil Daley

---

**Product Name:** TRS-80 Model 100 portable computer  
**Equip. req'd:** 4 AA batteries (\$3.00)  
**Price:** 8K \$799, 24K \$999  
**Manufacturer:** Tandy Corporation  
 Fort Worth, TX

**Description:** Gets my vote for product of the year! A truly useful portable computer. Includes all needed software and hardware interfaces for effective use alone or with other computers. 90 day limited warranty. Highly recommended.

**Pluses:** CMOS 80C85 processor and memory allows up to 20 hours of operation at 2.4MH without a cord. Large 8 line by 40 column LCD display is easily usable indoors and out. Includes full-size full-stroke keyboard, able to generate all ASCII codes, character and high-resolution graphics, and emulate a numeric keypad. Alpha lock, function keys, and cursor controls also supported. Interfaces include a 300 cursor controls also supported. Interfaces in-



clude a 300 baud modem (direct connect cable \$20, acoustic coupler planned), RS232 and Centronics parallel ports (cable \$15), and a 1500 baud cassette interface (cable \$6), as well as sockets for added RAM, ROM and an expansion bus.

Software is fully integrated, menu-driven and supported by function keys, providing ease-of-use comparable to Apple's "LISA" at 1/10th the price. The built-in word processor is simple but elegant, with all needed features. The smart terminal is entirely adequate for even serious use, as is the highly-extended Microsoft BASIC. A primitive address list and notebook are also included.

**Minuses:** Cursor controls are not supported from BASIC, and line-feeds after carriage returns are not selectable. The quick reference manual and the LCD display could use protective covers, and a built-in microcassette recorder and TV output would be welcome.

**Documentation:** Comes with a tiny quick reference manual and large spiral-bound user guide with index. Includes enough information in the first few pages to use all programs effectively, and covers all details of use later in a format that is ideal for reference. Does not attempt to teach BASIC to beginners.

**Skill level required:** My 7 year old used it easily the first day. What more can I say?

**Reviewer:** Jim Strasma

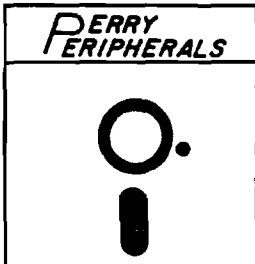
**Product Name:** 64K Disk Utility Package  
**Equip. req'd:** TRS-80 Color Computer Disk system 64K  
**Price:** \$21.95 + \$3.00 shipping  
**Manufacturer:** Spectrum Projects  
 93-15 86th Drive  
 Woodhaven, NY 11421

**Description:** The 64K disk utility package is a collection of three useful programs for the 64K Color Computer. Now that Tandy is producing a 64K compatible computer, and many users are upgrading their machines to support 64K, commercial software is starting to use the capacity. The program includes 40K, ROMCRACK, and a print spooler. 40K is a program that moves BASIC from ROM to RAM, and relocates it so that your BASIC programs have access to larger data areas. ROMCRACK will transfer ROMpacks to disks, and the software spooler will allow you to run and use BASIC while the printer is getting spooled output from a buffer in upper memory.

**Pluses:** 40K provides extra data storage area for large string arrays, etc. The print spooler will allow you to continue programming or working with your computer while printing from a large buffer in the upper RAM. ROMCRACK will transfer most ROMpacks to disk with very little hassle.

**Minuses:** 40K has a limiting factor in program size, and the extra memory must be used as variable and string space, or the program could crash. The print spooler works

*(Continued on next page)*



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well with three reservations, it must be available by the time you read this. It slows the computer down, programs run slightly slower. Lastly, the program data being spooled must use BASIC's character output routine (not usually a problem). ROMCRACK won't handle some ROM packs that test to see if the program is residing in RAM before executing. Some packs fit this category.

**Documentation:** A single sheet of information instructs thoroughly in the operation of the three utilities.

**Skill level required:** These utilities are for the average BASIC programmer, no great skills are required of the user.

**Reviewer:** John Steiner

**Product Name:** Disk COLORCOM/E Smart Terminal Software

**Equip. req'd:** TRS-80/TDP 100 Color Computer/MODEM

**Price:** \$49.95 + \$2.00 shipping

**Manufacturer:** Eigen Systems  
P.O. Box 10234  
Austin, TX 78766

**Description:** The Disk COLORCOM/E Smart Terminal program is a sophisticated terminal program that supports up/down loading, disk files, and a full complement of RS-232 functions and features.

**Pluses:** The program is easy to use, and very sophisticated. It is menu driven, and the user can set up just about every possible printer/modem computer parameter desired. All 127 ASCII codes may be sent from the keyboard. The receiver buffer can be opened for saving of data, and closed as desired if you decide to eliminate excess information from your disk. The software handles graphics characters easily, and does an impressive job on Spectrum Projects BBS graphics displays. Initialization files can be saved and loaded for maximum convenience.

**Minuses:** The software comes on a copy protected diskette, so you must load and run the program from it, transferring to a file disk when loading is complete.

**Documentation:** A 23-page manual is included that steps the user through the program with ease. Some functions needed further explanation for me, for example, "capture characters".

**Skill level required:** The program is easy to learn, and beginners can use it with little trouble, ignoring its advanced features. As the user becomes more expert, the extra capability can be put to use.

**Reviewer:** John Steiner

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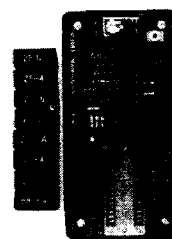
- 2508, 2516, 2532, 2564, 2758A,
- 2758B, 2716, 27C16, 2732, 2732A,
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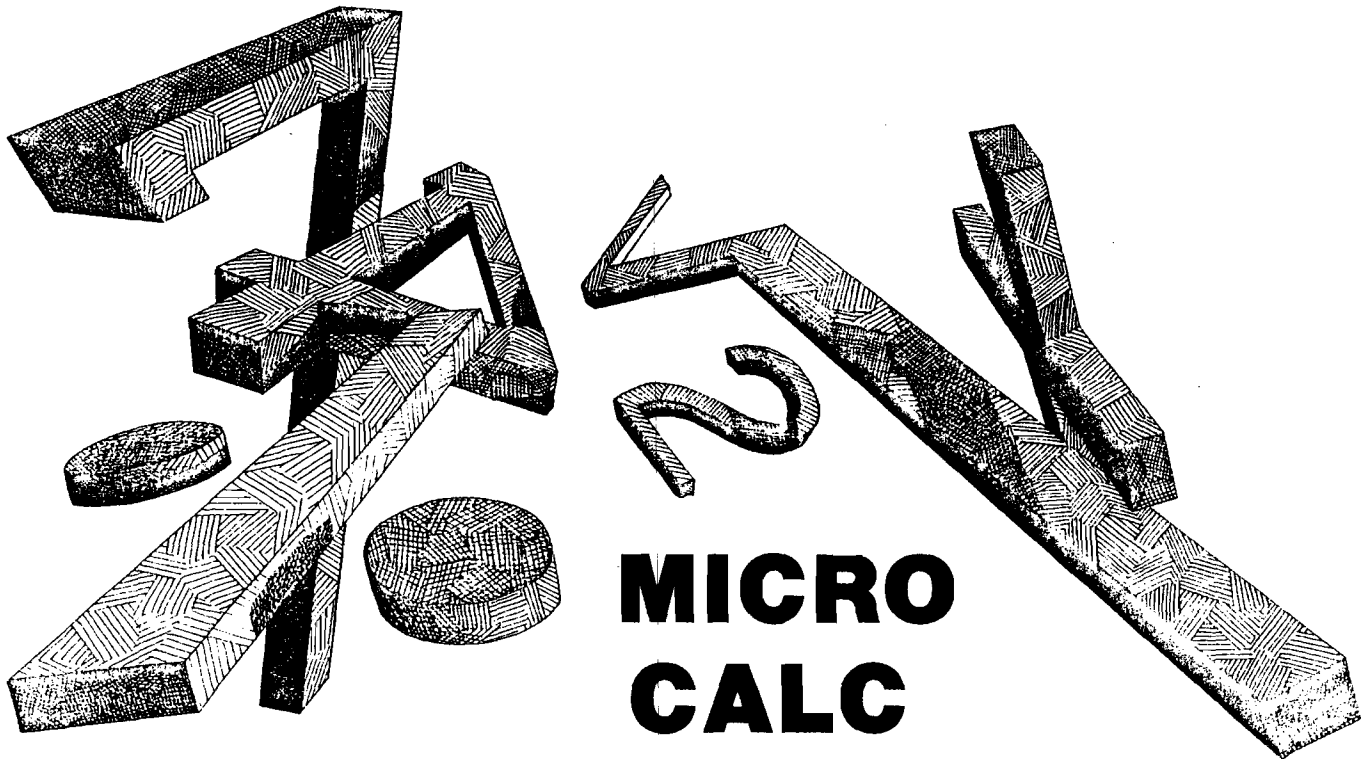


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# MICRO CALC

by Tom Marshall

## Comments on Atari listings

Starting this month, our Atari listings are being output on the EPSON FX-80 printer. This printer allows redefining some or all of the Epson ROM character set. After much testing, we arrived at a compromise set of characters. Since many of the reversed characters would be difficult to read at the size of these listings, we thought that it would be clearer for the reader typing these programs into his computer to underline the reversed characters. The Atari programs that follow utilize this new style of listing. If anyone has any comments, pro or con, drop us a line with your viewpoint.

## Features:

- ✓ 24 working lines
- ✓ 24 corresponding comment fields
- ✓ support of disk or tape files
- ✓ multiple statement support
- ✓ BASIC screen editing features

## Operating Instructions

ESC START performs calculations  
 ESC OPTION enters file mode  
 ESC SELECT enters comment field  
 Shift CLEAR clears screen

### Listing 1

```

3 REM MCALC
4 REM
9 POKE 106,PEEK(106)-4:GRAPHICS 0
10 DIM TBLO(255),STO$(800),DX0(3),DY0(3),TEMPO$(200)
    ,ULO$(25),FO$(15),MO$(54),QMO(20),SPACE$(40)
20 GOSUB 30000:GOTO 300
100 GET #1,C0:TY0=TBLO(C0):IF NOT (TY0) THEN 100 G
110 DN TY0 GOTO 120,130,200,140,160,150,170
120 POSITION X0,Y0:PRINT CHR$(C0);:PO=(Y0-1)*40+X0+1:
    ST0$(PO,PO)=CHR$(C0):X0=X0+1-LLO*(X0=MAX0):
    GOTO 100
130 X0=X0+DX0(C0-28):Y0=Y0+DY0(C0-28):
    IF X0<MAX0-LLO+1 THEN X0=MAX0 B
132 IF X0>MAX0 THEN X0=MAX0-LLO+1
134 IF Y0<1 THEN Y0=20
136 IF Y0>20 THEN Y0=1
138 POSITION X0,Y0:PRINT "+*";:GOTO 100
140 X0=X0-1+LLO*(X0=MAX0-LLO+1):POSITION X0,Y0: L
    PRINT "-*";:PO=(Y0-1)*40+X0+1:ST0$(PO,PO)=" ":
    GOTO 100
150 X0=MAX0-LLO+1:Y0=Y0+1-20*(Y0=20):POSITION X0,Y0:
    PRINT "+*";:GOTO 100
160 POSITION X0,Y0:PRINT "?":X0=X0+1-LLO*(X0=MAX0):
    IF X0>MAX0 THEN PRINT ULO$(1,MAX0-X0+1);
162 PO=(Y0-1)*40+X0:ST0$(PO,PO)="?":QMO(Y0)=PO:
    POSITION X0,Y0:PRINT "+*";:GOTO 100
170 POSITION 0,22:PRINT "Q Clear screen:
    Are you sure...?":GET #1,C0:
    IF CHR$(C0)<>"Y" THEN 300
172 FOR Q0=1 TO 20:POSITION 1,Q0:
    PRINT ULO$(1,11);" ";ULO$(1,25):NEXT Q0
174 ST0$=" ":ST0$(800)=" ":ST0$(2)=ST0$:GOTO 300
    
```

(Continued on page 82)

# Hewlett Packard

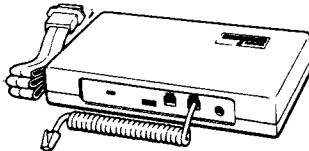
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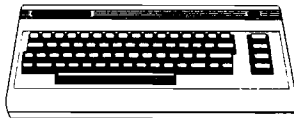


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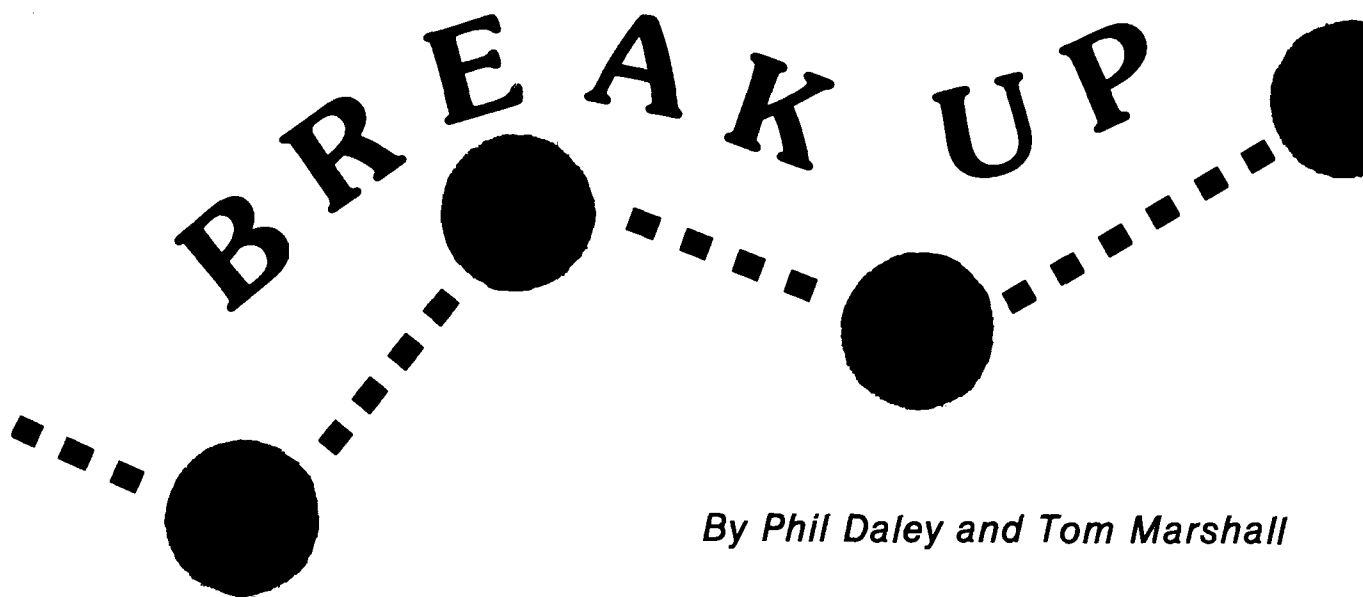
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*By Phil Daley and Tom Marshall*

A simple animation demonstration of PEEKing and POKing screen memory.

### A Brick Wall Demonstration

**G**et ready to hit the bouncing ball with your bumper and knock out a few bricks. The farther away the brick is, the more points you will get for knocking it out. If you are dexterous enough to knock out the entire wall of bricks, don't get over confident, the game will continue with an even harder screen of bricks.

Breakup is a simple graphics display game that presents the principles of animation with player/missile graphics to move characters on the screen and test for collisions. It includes a "ball" that moves around the screen, rebounds from struck objects, and knocks out bricks in the walls of bricks. It also includes a player-controlled "bumper" to keep the ball from going out-of-bounds and being lost, a defined playing field with three walls from which to bounce the ball, and some eight rows of blocks, the amount of points received for hitting them dependent upon their color and distance from your bumper.

The game keeps score by color; 5 points for the green at the bottom, fifteen for the blue above it, and twenty for the yellow-orange blocks just above that. When you clear the entire screen, you are awarded an extra ball, the paddle shortens by one dot and moves closer to the blocks. This continues, screen after screen, until the bumper is as small and as close to the bricks as it can be. In addition, the points received for hitting the blocks are all increased by 3 points. That is, when you are playing the second screen, the green blocks at the bottom of the screen are eight points. If you manage to get to even the next screen, they will be worth eleven, and so on. Unlike the size of the bumper, the values for the bricks have no limit, and may increase in value for as long as you can play the game.

### Operating Instructions

1. Key in 'BREAKUP' from the listing and save it on your tape or disk, and then RUN it.
2. First you are asked whether you will play from paddles or the keyboard. Choose the corresponding letter — P, or K.
3. The program will display the playing field, the brick walls, and your bumper. When you are ready to start play, press the button on the paddle, or the START key on the system console.
4. If you have chosen the keyboard use the cursor left arrow and cursor right arrow keys to move the bumper left and right. Holding the shift key at the same time increases the speed of the bumper.
5. If, for some reason, you halt program execution with the Break key, you must hit the SYSTEM/RESET key before re-RUNing. This will be further explained later.

### The Program

The ball starts from a random position at the bottom of the screen and travels upwards, hitting a brick. This causes the brick to disappear, adds the appropriate amount of points to your score, and rebounds the ball towards the bottom. Here is the challenge: You must hit the ball back with your bumper to keep the ball from traveling out-of-bounds and off the screen, thereby losing the ball. If you are successful, the ball will simply hit another brick and bounce back. If you miss the ball, a buzzer will sound and the program halts until you hit the paddle or the START



button. You are allowed six balls total, plus an extra one for every screen you clear. Also, the angle and relative speed of the ball increase the closer you hit the ball to the ends of the bumper. Hitting the ball near the center of the bumper helps to restore the ball to a less radical angle.

### **Breakup's Animation: The Idea of Player-Missile Graphics**

The animation in Breakup was done with the Atari's Player-Missile (PM) graphics capabilities. I used PM graphics because the speed of moving figures (players) around on the screen, such as the ball and paddle, is very fast. Also, PM graphics makes it very easy to test for collisions. This makes for a faster and more challenging game. In fact, even machine language versions of this game, which generally don't have to worry about speed due to the speed inherent in machine language programs, use PM graphics because of its ease of use.

A player is a zone on the screen that is eight pixels wide and extends vertically off both the top and bottom of the screen. A missile is generally a very thin player; it is only two pixels wide and likewise, extends past the top and bottom of the screen. There are several locations (registers) that correspond to the characteristics of each of the players and missiles, such as color, pixel width, priority, collision detection, and horizontal position of each. The reason the players and missiles are so relatively thin when compared to their height, stems from the fact that there is no vertical position register for them, only a horizontal position register. This means that in order to move a player vertically (as needed by the ball, for example), we have to physically redraw the player either higher or lower in memory. But before we deal any further with the describing locations of PM graphics, let's first uncover how the Atari handles PM graphics in the first place.

The Atari allows for four separate players on the screen and four missiles, or five players if you combine all four missiles and treat it like a player. There are in general, two types of players, those drawn in one line and those drawn in two line resolution. One line resolution is just that; the players are drawn out one scan line at a time. Two line resolution is simply drawing the players out two scan lines at a time. One line resolution, while it allows for better looking pictures, takes 2K of memory to store, while two line resolution takes 1K of memory to store. Each player in one line resolution takes 256 bytes to describe (one for each scan line from the very top of the screen to the bottom), and each player in two line resolution only takes up 128 bytes as each byte corresponds to two scan lines instead of simply one. Note that not only does the better resolution take up more room, but the memory used for it must start on a 2k boundary (the starting location must be divisible by 2048) while the two line resolution memory only has to start on a 1K boundary (starting location is divisible by 1024). Thus we have to be somewhat careful in our placement of the player-missile memory.

The Atari finds this memory through its base address register, which is location 54279. That is, location 54279 tells the Atari where to go to find out what the Players look like. But since the location is only one byte in size (it is only one location) it has to hold the *page number* of the

PM memory. A single byte, which can hold any number from 0 to 255, will be able to address any one of the 256 pages in the Atari. The paging method is simply a way for the Atari to find its way around with only one byte telling it where to go.

### **That's the Way the Ball Bounces.**

Another time saving feature of PM graphics is its collision detection capability. A collision occurs when any player or missile touches something other than the background. This capability allows the program to, with a single PEEK statement, find out if anything is hitting any one of the players or missiles, or if they are touching anything. This makes the whole checking routine for the ball and paddle collisions very fast.

The way this collision detection works is simple. There is a register for every possible PM collision. The Player to Playfield collisions register is the location that is read constantly to see if the ball (player 0) has hit something, so that the appropriate ball movement routine can be activated. Similarly, the player to player collision register is read to see if the paddle has hit the ball.

### **Combining a few things...**

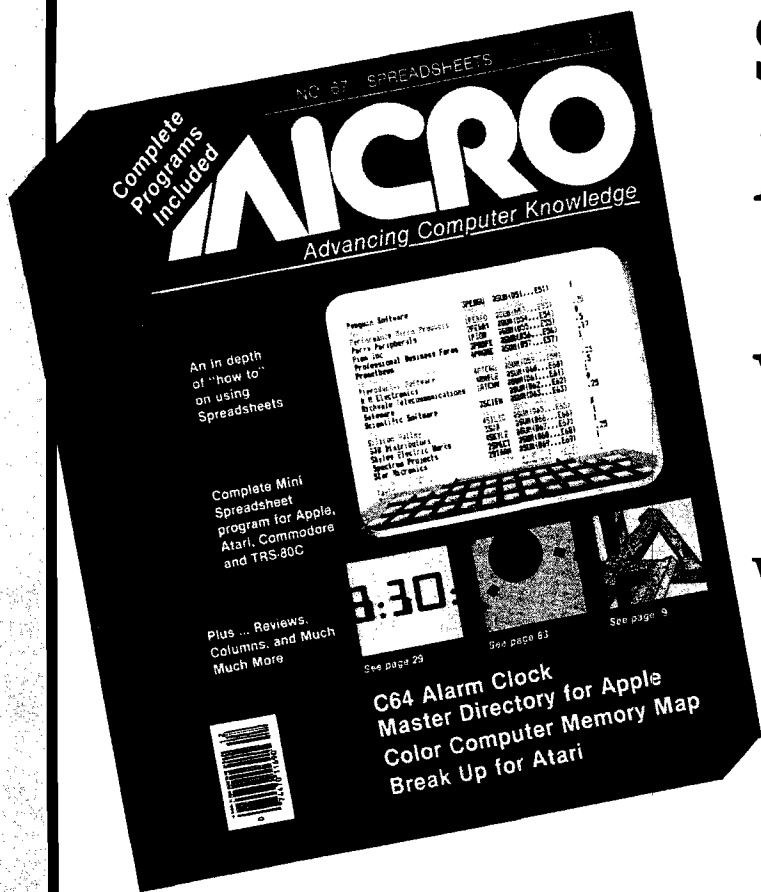
To make the colored bricks, we used redefined characters in graphics mode 2. We used characters simply because of the color capability, and ease of drawing and erasing. Characters in graphics mode 2 can be displayed as four different colors. So, we re-defined the character "\$" to a 7 dot x 5 dot brick.

The first 384 bytes of memory (in double line mode) are always unused. And the first 512 bytes remains unused because this program did not enable the missiles (everything is done with the players.) This means that we have 512 bytes sitting there on a 1K boundary, doing nothing. This is perfect for a graphics 2 character set. By using this space for the somewhat altered character set, we can store something that would normally require 1½K (1K for the PM storage, and ½K for the character set) in only 1K.

The actual movement of the ball was calculated out in BASIC and executed in machine language. This is because, as mentioned earlier, PM graphics is great and quick for moving figures horizontally, but vertical movement must be done manually. BASIC proved to be much too slow for this. There are other ways around it, but having a machine language routine was the easiest.

### **Program Description**

The routine to move the ball and the paddle, test for collisions, and do anything else involving animation is entirely contained in the lines 100 to 190. Note that this routine is almost at the very top of the program; all initialization and other routines are done below it. This is a programming trick to speed up the game, because the more lines that exist above a routine, the slower that routine will be. This has to do with the fact that when a GOTO is encountered, BASIC starts looking for the destination line number from the top and checks them all one by one until it finds where it has to go. This takes



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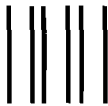
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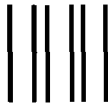
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time, and if you have a lot of lines above the routine, this will take a lot of time. Therefore all routines that are not time dependent, such as the initialization and score keeping routines, appear below the movement routine. In this way, no time is wasted during the movements.

Line 10 dimensions all the strings and arrays used by the program: M\$ holds block move routine discussed in previous chapters, M2\$ holds the ball movement routine, BALL\$ holds the Player-Missile description for the ball (only twenty bytes worth), A holds the possible angles resulting from a collision with the bumper, P holds the points for each line of bricks on the screen, and PAD holds the descriptive byte that describes how the paddle looks from screen to screen. All of these will be covered a little better in a minute.

Line 20 calls the initialization routine at line 30000.

Line 30010 lowers the top of memory pointer by 1K (four pages) to make room for the player-missiles and new character set. Fortunately, location 106 points to a 4K boundary, so subtracting 1K from this location insures that the location will be on a 1K boundary (it will be divisible by 1024). The graphics 1 screen is initialized right after the pointer is moved, so that the computer can re-adjust the appropriate pointers to the new loss of 1K memory.

In line 30012, START is assigned the address of the new memory area, and the two machine language routines are loaded in.

Line 30014 pokes the starting location with a zero and propogates it through the entire 1K by moving 1023 bytes from the starting location to just the following location.

Line 30020 uses the Block Move routine to move the standard character set from ROM to the new memory allocated just before the PM memory area. This allows us to redefine the few characters we have to and keep the rest of them as they are.

Line 30030 and 30040 make players 2 and 3 into the left and right walls of the game. These walls could have been merely character, as is the top wall above the bricks, but they were made as players so that a single check could be made to determine if the ball should bounce horizontally or not.

Line 30044 puts the description of a 7 dot wide paddle into the player 1 area.

Lines 30050 to 30054 redefine the two characters whose internal value is 4 and 5 ("\$\$", and "%") respectively, to the brick and solid block. The latter is used in the drawing of the wall on the top of the screen.

Lines 30060 to 30066 define the values of all the constants in the program. The majority of these are the locations for characteristic changes in the player missiles.

Line 30070 opens the keyboard for later input. It will remain open during the entire execution of the program.

Line 30080 sets up all the game values. (See the variable tables for details).

Lines 30082 to 30090 load in the values for the A, P and PAD arrays.

Lines 30100 to 30120 asks the user if he wants to play via paddles or the keyboard. CTRL holds the line number of the appropriate bumper routine.

The routine found at lines 30200 to 30260 initialize the screen. The PM graphics are enabled, the character set is

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enabled, and the bricks and walls are set up.

Line 50 pauses the game until either the paddle or START button is pressed. This gives the user time before the ball is released.

The entire game is controlled through lines 100 to 190.

In line 100, the horizontal and vertical displacements are added to the X and Y coordinates of the ball. Then the paddle is moved (CTRL is the line number of the appropriate routine). A machine language routine that moves the ball within the player is then called. This is what happens in the routine:

The routine is passed the following values:

- x coordinate,
- y coordinate,
- the starting location of the ball description,
- the start of Player 0 (where to put the ball),
- and, how many bytes of the ball description to move.

Player 0 is moved horizontally (only one location to change)

Player 0 is moved vertically

The collision registers are cleared

The routine then waits for 1/60th of a second, and then returns to BASIC

Clearing the collision registers is performed by the internal workings of the Atari whenever location 53278 is POKEd with any number. 1/60th of a second is waited out to allow the collisions to register.

Line 110 assigns the needed collision registers to the following variables: BPF (for the ball to character collisions), BPL (Ball to wall collisions), and PB (Paddle to ball collisions). Y is then checked to see if the ball has been missed.

Line 150 turns off any sound that may have turned on by some previous collision. BPF is then checked to see if it has hit playfield 0, 1 or 2 (one of the hittable bricks. If a collision has occurred, then control is passed to the brick routine at line 200.

Line 160: If the ball has hit playfield 3, then reflect (negate) the vertical displacement and make a sound.

Line 170: If the ball has hit either wall, then horizontally reflect it and make a sound.

Line 180: If the paddle has hit the ball then vertically reflect it. H is then assigned the appropriate angle of horizontal reflection. A sound is made.

Line 190 returns control back to line 100 in the event that none of the above has occurred.

Lines 200 to 210 handle the brick colliding routine:

Line 200 prints a space over the brick, effectively erasing it, adds the appropriate amount of points to the score, vertically reflects the ball, makes a sound, and subtracts one from the number of bricks variables (NB).

Line 202 prints the score. If NB is zero, then control is passed to the new screen routine.

Line 210 passes control back to the main loop.

The value of CTRL is set in the routine at 30100, and is either a 300 or a 400. CTRL is the line number of the appropriate bumper routine. If the game is controlled by the paddles then CTRL is 300, and if it is controlled by the keyboard, then CTRL is 400. Line 300 assigns the variable PP with the paddle position negated and moved to the right a little. The Paddle value was negated so that paddle movement would correspond to the bumper movement on

the screen. Lines 400 to 420 move the paddle left or right one pixel depending upon whether the left or right arrow key was held down. If the shift key was held down then the paddle is moved in the direction specified by five pixels instead. This allows the paddle to speed up if it has too.

Lines 500 to 550 contain the missed ball routine. If the number of balls left is greater than zero then, the game values are re-initialized, the number of balls left is decremented by one, and the game resumes at line 50. If the number of balls is zero, then the game is over, and you are asked if you wish to try again. If you specify "N", then the top of memory pointer is reset to its original spot, and the program halts. If "Y" was specified, the top of memory pointer is reset, and the program is re-RUN. Note that if the program is stopped via the Break key, and rerun, the top of memory will be even lower than it was before. If this is continued, the computer will eventually run out of room and unrecoverably crash. It is for this reason, that whenever the program stops via the Break key, the user should hit SYSTEM/RESET.

Lines 600 to 690 handle the screen clear routine. If it can be done, the paddle is shorted by one pixel and moved up three lines. This is done at line 610 by block moving the description bytes for the paddle up one byte three times. Between each move upward, a sound is briefly made and a delay occurs, so that the changing of the paddle is more obvious. SZ is a flag telling the program that there is still room to move the paddle upward three lines and that the paddle can still be shortened. It is incremented every time the paddle is raised. If SZ ever reaches 7, then the paddle is no longer raised or shortened every time the screen is cleared. The points received for each brick struck is also increased by 3 for each consecutive screen. When this routine is done, the game values are re-initialized and the game resumes at line 50.

The DATA statements on lines 32010 and 32110 hold the two machine language routines in string form. These are read in to the appropriate strings during the initialization routine.

The rest of the DATA statements on lines 32210 and 32220, 32310, 32410, and 32510 hold the values for the new characters in the character set, the paddle angles, the points received for the blocks per line, and the paddle sizes per new screen, respectively. They are likewise read into their appropriate variables during the initialization routine.

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You may contact the authors at MICRO Magazine,  
Box 6502, Amherst, New Hampshire 03031.

#### Listing 1

```
10 DIM M$(54),M2$(99),BALL$(20),A(7),P(23),PAD(6)
20 GOSUB 30000
50 IF PTRIG(0) AND PEEK(53279)<>6 THEN 50
100 X=X+H:Y=Y+V:GOSUB CTRL:POKE P1,PP:
    U=USR(BALLX,Y,X,Y,BALL,STP0,14)
110 BPF=PEEK(POPF):BPL=PEEK(POPL):PB=PEEK(P1PL):
    IF Y>111 THEN 500
```

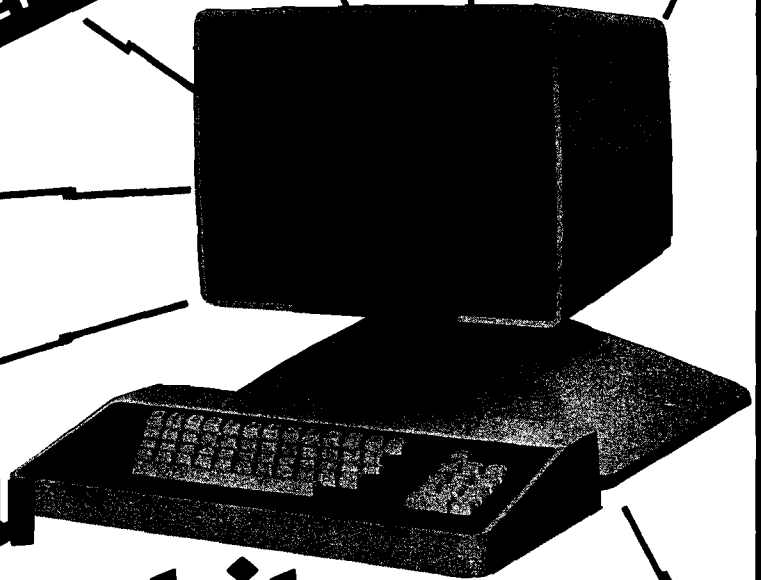
*(Continued on next page)*



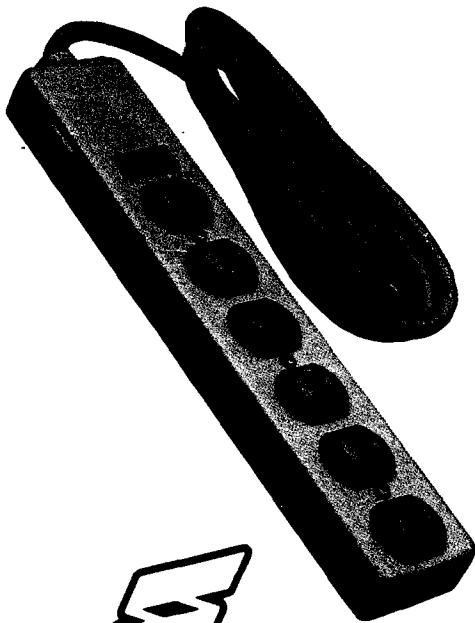


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# MICRO™

## From Here To Atari

by Paul S. Swanson

The listings accompanying this column provide my Christmas greetings to you. The assembly code is for reference. The BASIC program contains the resulting machine language in the data statements. It is an example of using display list interrupts. Enter the BASIC listing to see a color display.

Several display list interrupts control the changing colors in the triangular "tree" in the display and two more are used to color the trunk and to change the text window background to black. Every line of the mode 5 triangle has an interrupt on it. The colors are rotated under the control of the BASIC program.

The BASIC program begins by drawing the tree using dots of random colors. The background color is the only one not used in that section. Later, the display list interrupt will constantly alter the contents of the referenced color registers. The trunk is drawn with the color from register 2, which is declared in BASIC with COLOR 3. This is the same color register used for the text background.

Establishing the points for the interrupts is done in lines 120 through 160. First, DL is set equal to the location of the display list. Next, all of the bytes controlling lines 1 through 31 are altered. The 138 used is the code for GRAPHICS 5, which is 10, plus 128, which sets the display list interrupt enable bit. The tree occupies screen lines 1 through 30 and screen line 31 is the first line on the trunk. The line before the text window gets the last interrupt, which will be used to set the text background to black.

The display list interrupt is read into page six in lines 170 through 190. The vector is set up to point to the routine in line 200 and the first statement in line 210 enables the interrupt. Q is used to control the color base for the interrupt routine and A controls whether the message is "MERRY CHRISTMAS" or "HAPPY NEW YEAR."

The BASIC loop that occupies lines 220 through 280 alters the color base and prints the messages. The interrupt is going constantly, so the BASIC program does not need to call anything. All that it changes is the contents of location 1664, which is used by the interrupt as the color base. The two phrases, controlled by A, are printed using the loop at lines 230 through 260. The FOR/NEXT loop within that loop controls the timing for printing the individual letters. Lines 270 and 280 dorm a delay at the end of each phrase, then set up A to point to the other phrase.

The assembler routine starts by saving the three registers on the stack. Since it is interrupting the program and it will use these three registers, they must be saved. Otherwise, the program that is interrupted will have the wrong values in the registers when the interrupt returns.

VCOUNT contains the number of the current screen scan line divided by two. This will serve to divide the in-

terrupt into three parts. The triangle shape requires a color rotation, the trunk requires that register 2 be set to brown and the text window requires that register 2 be set to black. VCOUNT is 79 at the interrupt where the trunk color is to be selected, so it is compared to 79. If it is found to be 79, a branch is made to STUMP, where brown is stored in register 2. If it is found to be greater than 79, a branch is made to WINDOW, where register 2 is set to black.

If it is neither equal to nor greater than 79, the color rotation is performed. Since the interrupt happens during the last scan line of the previous mode line, a STA WSYNC, which stops the processor until the end of the current scan line, must be performed before the registers are changed. Preparation for this involves placing the proper colors into the 6502 registers.

The colors are based on whatever is in location 1664, which is controlled by the BASIC program. This is added to VCOUNT and placed in register Y. For register X, \$15 is added to the color and \$2A is added for register A.

The STA WSYNC is performed next, immediately followed by the three statements that place the colors in the registers. Although the timing is not critical in this program, because the colors affected are not near the left edge of the screen, the placing of the colors takes place totally within the horizontal blank period. The three store commands require 12 machine cycles and there are 26 in the horizontal blank period, although a few of these are stolen by DMA.

Since the color changes are not critical for the trunk and the text window, WSYNC is ignored and the colors are stored directly into the color registers. The \$26 is equivalent to SETCOLOR 2,2,6, which is the brown used for the tree trunk. In WINDOW, the background is set to black and the text (register one) is set to a medium white.

The EXIT routine must restore the three registers in the reverse of the order in which they were stored on the stack. After restoring the three registers, the interrupt mask (processor I bit) is cleared and the return from the interrupt is performed. The processor I bit is set when the interrupt is called and leaving it set prevents other interrupts from altering the timing in this interrupt.

### POKEY Timers

Another interesting set of interrupts are controlled by POKEY, which is the device responsible for the sounds and operation of the serial I/O bus. There are three POKEY timer interrupts available for general program use, referred to as POKEY timers 1, 2 and 4. These use the values in the AUDF registers, which are the same ones used for generation of sounds.

The advantage to the POKEY timers over the display list or vertical blank interrupts is that they are controlled through independent counters. Display list and vertical blank interrupts depend on the 60 Hz television frame rate and cycle at that frequency. The POKEY interrupts are completely controlled by frequencies which can be set by software.

To get an exact frequency with a POKEY timer is not that easy unless the frequency you want is an even multiple of the clock rates. There are three clock rates available, just as there are for the sound channels. In fact, they are

the same sources. The "normal" frequency, which is the one selected when the system is booted, is 63.9210 KHz. This may be changed to count at 1.78979 MHz or 15.6999 KHz. When the interrupt routine is enabled properly, an interrupt happens each time the counter reaches zero. The frequency set for the clock rate can be used to calculate the frequency of the interrupt. The interrupt frequency is equal to:

$$\text{the clock frequency} / (2 * (1 + \text{number in the AUDF register}))$$

POKE the value N into the register and the frequency of the interrupt is the frequency set (the 64 KHz or 15.7 KHz) / (2 \* (N+1)). For 1.79 MHz, there is a slight modification of the formula. Divide the 1.79 MHz by two times the sum of N plus 4. If you are clocking two channels together, use 7 instead of the four. If you don't know what that means, use 4.

When you use the timer interrupts, pay close attention to what is on the system stack. Before jumping through the timer interrupt vector, the operating system pushes the A register onto the stack. Before your routine starts, you should push the X and/or Y registers onto the stack if you intend to use them. Before you return from the interrupt, pull X and/or Y registers off the stack, then PLA and clear the interrupt with CLI. If all that was pushed onto the stack is not pulled off, or if more is pulled off than was put on, the system will crash or at least lock up as soon as you enable the interrupt.

The method for implementing the POKEY timers is stated inaccurately in the manuals. If you set it up the way the manual states, your system will lock up and you will have to press SYSTEM RESET to continue. Instead, first set up AUDCTL (\$D208, or 53768) with zero for 64 KHz, one for 15 KHz or 96 for 1.79 MHz. Next, set the volume [AUDC1, 2 or 4 at \$D201, \$D202 or \$D204 53761, 53762 or 53764]. Now you can set up your software interrupt routine and change the interrupt vector to point to it. The three vectors are at \$0210, \$0212 and \$0214 (528, 530 and 532). The above steps can be in any order. After all of them are completed, start the timer by POKE 53769,0 (actually, any number from 0 to 255 can be POKEd here and you will get the same effect). After all that is done (not before the POKE 53769, which is what the manual states), enable the timer interrupt.

Enabling the interrupt involves PEEK(16). Add 1, 2 or 4 to that value, which corresponds to the interrupt you are using, and POKE the number back into location 16 and also into location 53774. Once you do that, your interrupt will begin and an interrupt will be generated when the timer you set counts down to zero. As soon as the interrupt happens, the timer is automatically loaded with the value you originally POKEd there, so the process repeats until you disable it.

### Problems to Watch For

Problems associated with POKEY timer interrupts involve timing and other interrupts. DMA can alter, unpredictably, the amount of time between the interrupt and the first action taken by your interrupt routine, making the timing a little less precise. The average over several interrupts will be at your selected frequency, but the timing

between two consecutive actions may be off by a few clock cycles if DMA is not disabled.

Other interrupts can also introduce problems. The major problem is the vertical blank interrupt. The only solution to this is to turn off the interrupt, and the display list interrupts if any are enabled, by POKEing a zero to location 559. Make sure you do all your SETCOLOR, GRAPHICS and other statements that depend on shadowing first or resort to using the hardware registers. That POKE also turns off the real time clock and keyboard auto-repeat.

Another interrupt source is the IRQ interrupts. These can be masked out by setting the corresponding bits in locations 16 and 53774 to zero, storing only the 1, 2 or 4 for the POKEY interrupt in those locations. Another possibility is to SEI at the beginning of the interrupt (don't forget CLI at the end).

If you do not disable the keyboard, you may get some additional delays on some of the interrupts. The keyboard click uses the STA WSYNC command, which stops all processing, including interrupt servicing, until the end of the current television scan line is complete. Also, any other interrupt that leaves the processor "I" bit set will cause the processor to ignore the interrupt. Peripheral access may do this.

If you set up the POKEY timers to do something for you, you may have few, if any, problems with them. The problems mentioned above can be used as places to check if the timing is found to be inaccurate. If you set everything up the way I have described and the system locks up when you enable the interrupt, your machine language may have a fatal error. If you find no error, turn the computer off then on to reboot and try it again.

One undocumented note on the POKEY timers is that you can change the frequency between interrupts. If the calculations for the desired frequency are not exactly what you want, maintain a counter somewhere in memory. At the beginning of the routine, use STA to put the value into AUDF that BASIC placed there. Increment the counter and test it to see if it counted to where you want to make an adjustment. If it is there, store the adjustment frequency into AUDF and reset the counter to zero. The next interrupt will obey the new frequency, then put the old frequency back into AUDF. Remember that this is not documented, so it may not work on all Atari computers. Test it out before you depend on it.

Enabling the POKEY timer interrupts involves a lot of calculation. However, if they are properly enabled, very precise timing can be done with them. I am preparing a project using those timers and I will be writing an article describing it completely.

### Next Month

I recently acquired an ATR8000, which is a device containing a Z80 processor, memory, a printer port, an RS-232-C port and disk controller logic so that you can hook up "bare" disk drives to your Atari. The ATR8000 offers CP/M compatibility and, when the CP/M option is not in use, the ATR8000 will act as a printer buffer. A functional description of the ATR 8000, along with pricing, will be featured in next month's From Here to Atari.

You may contact Paul at 97 Jackson St.,  
Cambridge, MA 02140.

**AKRO**

```

Listing 1
00005 * Listing 1
00010 *
00020 * DLI ROUTINE
00030 *
00040 * EQUATES
00050 *
D40B: 00060 VDCOUNT .EQ $D40B * SCAN LINE COUNTER
D016: 00070 COLOR0 .EQ $D016 * FOR SE.0,
D017: 00080 COLOR1 .EQ $D017 * FOR SE.1,
D018: 00090 COLOR2 .EQ $D018 * FOR SE.2,
D40A: 00100 WSYNC .EQ $D40A * WAITS FOR HBLANK
00110 *
00120 * INTERRUPT ROUTINE
00130 *
00140 .OR $600 * FOR PAGE 6
0600: 48 00150 DLROUT PHA * SAVE REGISTERS *
0601: 98 00160 TYA
0602: 48 00170 PHA
0603: 8A 00180 TXA
0604: 48 00190 PHA
0605: AD 0B D4 00200 LDA VDCOUNT * CHECK
0608: C9 4F 00210 CMP #79 * SCAN
060A: F0 1B 00220 BEQ STUMP * LINE
060C: 10 21 00230 BPL WINDOW
060E: 18 00240 CLC
060F: 5D 80 06 00250 ADC 1664 * ADD COLORBASE
0612: A8 00260 TAY
0613: 69 15 00270 ADC #15
0615: AA 00280 TAX
0616: 69 2A 00290 ADC #2A
0618: 8D 0A D4 00300 STA WSYNC * WAIT FOR BLANK
061B: 8D 1B D0 00310 STA COLOR2 * STORE COLORS
061E: 8C 16 D0 00320 STY COLOR0
0621: 8E 17 D0 00330 STX COLOR1
0624: 4C 39 06 00340 JMP EXIT
0627: A9 26 00350 STUMP LDA #26 * BROWN TRUNK
0629: 8D 1B D0 00360 STA COLOR2
062C: 4C 39 06 00370 JMP EXIT
062F: A9 00 00380 WINDOW LDA #0 * BLACK BACKGROUND
0631: 8D 1B D0 00390 STA COLOR2
0634: A9 0A 00400 LDA #10 * WHITE LETTERS
0636: BD 17 D0 00410 STA COLOR1
0639: 68 00420 EXIT PLA * RESTORE REGISTERS
063A: AA 00430 TAX
063B: 68 00440 PLA
063C: A8 00450 TAY
063D: 68 00460 PLA
063E: 58 00470 CLI * CLEAR INTERRUPT
063F: 40 00480 RTI * AND RETURN

```

## Listing 2

```

5 REM *** Listing 2 - Christmas Greetings
6 REM *** Program by Paul S. Swanson
7 REM ***
10 GRAPHICS 5
20 FOR I=0 TO 30:REM * DRAW TREE *
30 FOR J=40-1/2 TO 40+1/2
40 COLOR INT(RND(0)*3+1)
50 PLOT J,I+1
60 NEXT J:NEXT I
70 COLOR 3
80 FOR I=36 TO 44:REM * DRAW TRUNK *
90 PLOT I,32
100 DRAWTO I,38
110 NEXT I
120 DL=PEEK(560)+PEEK(561)*256:
REM * LOCATE DISPLAY LIST *
130 FOR I=DL+6 TO DL+36:REM * SET INTERRUPTS *

```

```

140 POKE I,138
150 NEXT I
160 POKE DL+44,138
170 LOC=1536:RESTORE :REM * READ DLI ROUTINE *
180 READ N
190 IF N<>256 THEN POKE LOC,N:LOC=LOC+1:GOTO 180
200 POKE 512,0:POKE 513,6:REM * ENABLE DLI *
210 POKE 54286,192:Q=255:A=0
220 RESTORE A+2000:? CHR$(125):
REM * PRINT MESSAGE *
230 READ N:IF N=256 THEN 270
240 ? CHR$(N);" ";POKE 1664,Q:Q=Q-1:
IF Q<0 THEN Q=255:REM * Q CONTROLS COLORS *
250 FOR I=1 TO 50:NEXT I:
REM * DELAY BETWEEN LETTERS *
260 GOTO 230
270 FOR I=1 TO 300:NEXT I:
REM * DELAY BETWEEN MESSAGES *
280 A=1000-A:GOTO 220
999 REM * DLI ROUTINE IN DECIMAL *
1000 DATA 120,72,152,72,138,72,173,11,212,201,79,
240,26,16,32,109,128,6,168,105
1010 DATA 21,170,105,42,141,10,212,141,24,208,140,
22,208,142,23,208,76,57,6,169
1020 DATA 38,141,24,208,76,57,6,169,0,141,24,208,
169,10,141,23,208,104,170,104,168,104,88,64,
256
1999 REM * MESSAGE #1 *
2000 DATA 32,77,69,82,82,89,32,67,72,82,73,83,84,77,
65,83,256
2999 REM * MESSAGE #2 *
3000 DATA 32,72,65,80,80,89,32,78,69,87,32,89,69,65,
82,256

```

MICRO

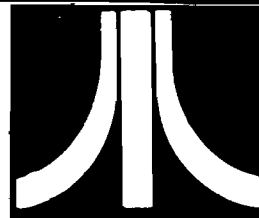
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**MICRO**<sup>TM</sup>**Atari Reviews**

**Product Name:** **Square Pairs**  
**Equip. req'd:** Atari Computer, BASIC, Cassette Player  
**Price:** ?  
**Manufacturer:** Scholastic Inc.  
 906 Sylvan Ave.  
 P.O. Box 2010  
 Englewood, NJ 07632

**Description:** A game of matching. Square Pairs allows up to four players to take turns uncovering two boxes at a time and finding two that match.

**Pluses:** Even though there are three games included, the most interesting part of the program is the ability to make up your own games. After making up a game it can be saved on tape. This allows for more game variety.

**Minuses:** The program is only available on tape and will only interact with a Atari cassette recorder.

**Documentation:** The sixteen page manual is clearly written. Most of it is applied towards making up and saving games.

**Skill level required:** Designed for seven through twelve years of age. May not have much attraction to those over ten.

**Reviewer:** Richard E. DeVore

**Product Name:** **Turtle Tracks**  
**Equip. req'd:** Atari Computer w/32K, BASIC, Disk Drive, Atari Printer optional  
**Price:** ?  
**Manufacturer:** Scholastic Inc.  
 906 Sylvan Ave.  
 P.O. Box 2010  
 Englewood Cliffs, NJ 07632

**Description:** *Turtle Tracks* is an interesting method for children to learn the fundamentals of programming. By typing in simple programs, they are shown, by a "turtle" drawing on the screen, exactly what their program does.

**Pluses:** The self-booting program is well error-trapped, allowing mistakes to be made without crashing. It allows loops and variables, demonstrating on the screen what they do. There is also a small segment on sound with enough information to let you compose simple music. If there is an Atari printer connected to the system, a print out of the screen may be made by just pressing the OPTION key.

**Minuses:** The program is slow in accepting keyboard input. The longer a program gets, the slower the cursor responds. Program execution is also slow.

**Documentation:** The eighty page manual is quite well done. It carries you from loading the program through saving and reloading your work. One of the clearest for children I have seen.

**Skill level required:** Beginner, recommended minimum starting age is nine years old.

**Reviewer:** Richard E. Devore

**Product Name:** **MMG Data Manager**  
**Equip. req'd:** Atari Computer w/48K, BASIC, Disk Drive; printer optional  
**Price:** \$49.95  
**Manufacturer:** MMG MICRO SOFTWARE  
 Manalapan 1000 Office Building  
 1000 Route 9  
 Englishtown, NJ 07726

**Description:** *MMG Data Manager* is a file management program for any Atari computer with sufficient memory and a disk drive. You may set up your records and fields to suit your particular needs. Although a BASIC program, it has machine language routines and is quite fast in use.

**Pluses:** The 26 page manual that comes with the program is quite clear and takes you step by step through the use of its features. The program is menu driven and simple enough to use that the manual may not be necessary after the first or second time a record is set up. The sort routine is extremely fast and may be used on up to three levels. The program is well error trapped, making use by the beginning computerist easy.

**Minuses:** There can be a maximum of only ten fields. The fields do not support computations. A record, once set up cannot be reconfigured. These minuses are features usually found in much more expensive programs and are not often available in this price range.

**Documentation:** The manual is easy to use and understand. It is a tutorial showing how each program function is used.

**Skill level required:** Beginning level user.

**Reviewer:** Richard E. DeVore

**Product Name:** **WORDRACE & WORDRACE Accessory Disk**  
**Equip. req'd:** Atari 400/800 w/32K & BASIC Cartridge  
**Price:** ?  
**Manufacturer:** Don't Ask Computer Software  
 2265 Westwood Blvd., Suite B-150  
 Los Angeles, CA 90064



**Description:** As the name suggests, this is a word game that tests vocabulary skills. Game players, from one to four, must find the correct definition of a word from six possible choices. The clock is ticking so find the correct answer as quickly as possible. Choose your strategy: guess quickly or take more time to study the definitions. Loose points for incorrect answers or too much hesitation. There are three levels of play for everyone from pre-teens to pun-dits. The number of words in each round of play is selectable, also. For those more interested in sports or famous historical persons, an extra-cost accessory diskette is available. After booting the system diskette, insert the alternate data diskette and the new game data will load.

**Pluses:** Challenging and educational. This game would also be a valuable (and fun!) way for a student to prepare for college entrance exams.

**Minuses:** The graphics are simply boring, but word game lovers will overlook this aspect of the software's design.

**Skill level required:** Age 9 to adult.

**Reviewer:** Tim Kilby

**Product Name:** Preparing For the SAT  
**Equip. req'd:** Atari Computer, Atari 410 Recorder  
**Price:** \$99.95  
**Manufacturer:** Program Design, Inc.  
 11 Idar Court  
 Greenwich, CT 06830

**Description:** *Preparing For the SAT* is a cassette based series of lessons designed to help prepare for aptitude testing, especially the Scholastic Aptitude Test. The lessons cover analogies, vocabulary, quantitative comparisons, and number relationships. There is one cassette devoted to the taking of aptitude tests with the back side containing a time program for practice. There are a total of six cassettes included with the manuals.

**Pluses:** Two of the programs have a voice narration included on the cassette for reinforcement. This is a feature used by PDI that I feel greatly enhances the learning process. The information included in the manuals is valid and the programs are well done. After a demonstration, the adults attending spent over an hour working with the various lessons. They not only felt they were learning but found it enjoyable at the same time.

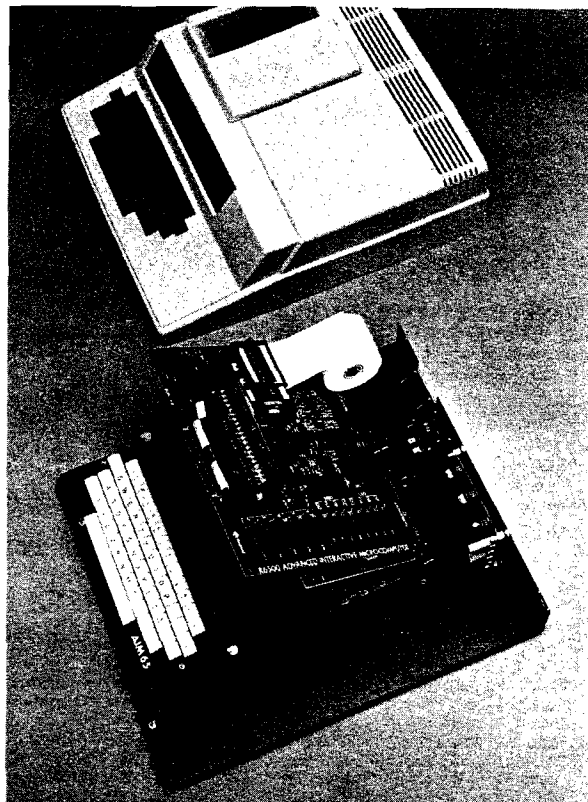
**Minuses:** Other than the fact that printed tests cannot be made from the programs, I found nothing to complain about.

**Documentation:** The programs come with two manuals. One is titled "Making The Grade, How To Take and Pass A TEST." This 34 page manual was written by the president of PDI, John Victor. He explains what the tests are, the best methods to use when taking them and shows examples of the types of questions used in the testing. The other 44 page manual explains how to use the programs and has a large section devoted to explaining the problems on the cassettes. They are well done.

**Skill level required:** High school student or anyone with an inquiring mind.

**Reviewer:** Richard E. DeVore

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# AIM HIGH

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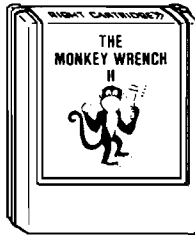
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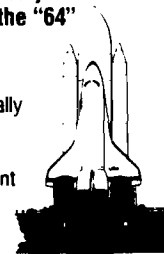
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# MICRO™ Interface Clinic

by Ralph Tenny

A computer can be interfaced to real time events, but if a computer is to be able to react with and control real time activities, it must know when the events are happening. There are two basic ways to accomplish this — polling and *interrupts*. An interrupt is a way to signal a running computer — gaining its attention — that it must delay further execution of the running program to service another event. Most modern microprocessors have provision for three kinds of interrupts. The first, called RESET, is used on startup and causes the microprocessor's internal registers to be set to a known condition instead of the random condition which happens when power is first applied. In addition, the internal RESET algorithm initiates certain operations, including reading an external memory location for (usually) the address of the programmer's idea of a proper initialization routine. This is called *indirect addressing*, which means that the first data read from memory is not an instruction but the *address* of an instruction.

Two other interrupts are common also. The IRQ (Interrupt ReQuest) is typically a *maskable* interrupt (meaning it can be turned off via a software flag), and the NMI (Non-Maskable Interrupt) are usually available on modern microprocessors. These interrupts cause some portion of the microprocessor's status to be saved so the interrupted program can be resumed in orderly fashion. Those of you with 6809-based machines also have three software interrupts (similar to the 6502's BRK instruction) and the FIRQ (Fast Interrupt ReQuest) which responds more rapidly than IRQ by saving fewer processor registers).

Programming for interrupts requires special precautions and programming methods. Not only do you have to have special *interrupt service* programs, you must carefully manage the interrupt enable bit and the associated hardware which causes the interrupt. It is universal practice that interrupt input pins are at logic one level during normal operation, and respond (issue an interrupt) when the pin is pulled to logic

zero. Usually, the NMI interrupt is edge-sensitive (a negative-going input is latched internally) so that the pin must go high and then come low again before another interrupt is accepted. IRQ inputs are usually level-sensitive; if the interrupt service routine is completed before the pin is released, another interrupt will be issued immediately. In one aspect, the microprocessor's response to either IRQ or NMI is identical — the current instruction is completed before the interrupt is honored. In most cases, the microprocessor also ignores further interrupts until the current interrupt service routine is finished. This is accomplished by using the RTI (ReTurn from Interrupt) instruction to terminate the service routine.

The program in the listing illustrates how to handle interrupts caused by the CD input of the serial port. This input drives the CA1 pin of the I/O PIA of the Color Computer, and the IRQ output from the PIA is connected to the 6809's FIRQ pin. The IRQ and the FIRQ interrupts each have their own disable flags. If either bit is set to logic one, the corresponding interrupt is inhibited or turned off. Unlike some processors (6502 for example) which directly set or clear status register bits, the 6809 uses special AND or OR instructions which set or clear selected status bit. One such example is shown in the listing one line above the label SPIN (\$301D) -ANDCC \$BF. If you remember how the logical AND works, any bit in the operand is set to zero if the corresponding mask bit is zero. In this case, the *bit mask* (pattern) is \$BF, which has all bits except Bit 6 set to logic one. Thus, Bit 6 in the operand (Condition Code register or Status Register) is set to logic zero; this *enables* (turns on) the FIRQ interrupt. Similarly, at the label QUIT (\$3055) the instruction ORCC \$40 is used to turn off the FIRQ interrupt. Refer to Figure 1, which shows the PIA Control Register and briefly identifies the functions of each Control Register bit. For now, we will skip a complete description of this register's functions; instead, note bits 6 and 7, which are IRQ

flags. CA1 is always an input and can be programmed as an interrupt; CA2 can be either an output or input/interrupt. Similar relationships are true for Control Register B, CB1 and CB2. If CA1 and CA2 are programmed as interrupts, Bit 7 responds when CA1 is pulled low, and Bit 6 responds to CA2. Last month's applications program polled the RS-232IN line (bit 0 of the port), but since our serial adapter also pulses the CD input, we could have polled bit 7 of the Control Register instead.

Let's examine the program flow in the listing. Beginning at the label START, the location BUFR (defined at the program's end) is cleared, then the time constant DVAL is stored in CoCo's baud rate buffer. The next command points the Y INDEX to the next location past BUFR; this can be omitted after program debugging; it simply provides a record of the input values to aid in troubleshooting. The next three instructions read the current value in the PIA Control Register, turn on Bit 0, and restore the modified value. This is the first of three steps required to completely enable the interrupt structure so this PIA can cause a processor interrupt.

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interrupt is to load the *vector*, which is the address of a routine to service (respond to) a particular interrupt. The 6809 microprocessor has provisions for eight interrupts, seven of which have been implemented and one has been reserved for future expansion. Upon receipt of an interrupt, the 6809 reads one of the eight two-byte values it finds in the memory space \$FFF0 to \$FFFF. When a Synchronous Address Multiplier (SAM) is in the system, as in the Color Computer, SAM forces these interrupts to be moved to \$BFF0-\$BFFF. If you examine memory (use a debug monitor or PEEKs), you will find some two-byte values stored as part of the BASIC ROM. Some of those addresses point to the memory area beginning at \$0100. Remember, the interrupt structure expects these address vectors to be indirect addresses which point to the interrupt service routine. Since these routines can be anywhere, and of any length, a *jump table* is used. This is a series of absolute jumps, listed one after the other in memory. So, for any of the vectors beginning at \$0100, you will find 7E XX XX, where XX XX represents the starting address of the interrupt service routine. The FIRQ vector is used to auto-start CoCo from a ROMPACK, so BASIC initializes the FIRQ vector at \$010F. If we wish our FIRQ service routine to be used, then we must substitute our vector for the BASIC vector. The three program steps beginning at \$3017 do just that. BASIC has already written the code \$7E (JMP) in location \$010F, so our program reads the address of INTSRV and writes two bytes (\$302A) beginning at \$0110. That is Step 2 needed to initialize an interrupt. Step 3 follows: read the port to clear Bit 7 in case CD has been pulsed while we were talking, and then enable the FIRQ interrupt. This cancels any pending interrupt which came in before we were ready, and allows our routine to begin with a clean slate.

In this particular case, our program simply goes into a wait loop, checking the keyboard to see if we push a key. Anytime an interrupt comes in, the eight bits captured by the serial adapter's input pin come spinning in, just as they did when we polled the RS-232IN line last month. This has been a slightly simplistic explanation, but it is accurate for any CoCo which does not have Extended BASIC. Extended BASIC runs a software timer based on IRQ, and triggered by a 60 Hz interrupt signal on CB1 of the keyboard PIA, but since FIRQ is a *higher priority* [more important] interrupt, our signal will dominate. Since our

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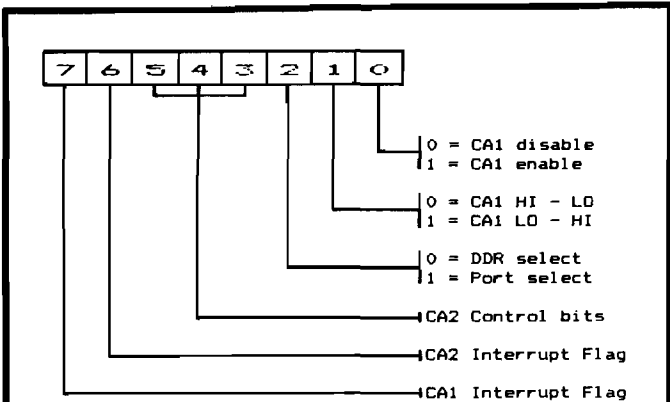
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**Figure 1. Control Register of the 6821 PIA. Bits 0 and 1 control the CA1 Interrupt input pin (see text).**

routine will run longer than the 16.6 millisecond period of the 60 Hz interrupt *each time it happens*, the BASIC clock will miss a "tick" every so often. If you depend on this clock, you may wish to poll the serial adapter instead of run it under interrupt control.

Once the interrupt happens, the code at label INTSRV begins to execute. Much of this code is identical to the previous programs which we have used to exercise the hardware, so let's concentrate on the differences. Just as we had to manage the interrupt entry software carefully, certain things must be accomplished by the service routine. The processor automatically disables both interrupt bits whenever either IRQ or FIRQ are asserted, and the RTI instruction restores the original interrupt enable status upon exit from the service routine. Obviously, the service routine must perform the intended task which created the need for an interrupt, but it must also *clear* the interrupt (prevent the same interrupt from being asserted again).

If external hardware can be cleared or reset to remove the stimulus, this must be done. If this cannot be done, the service routine must continually check for the hardware status, waiting for it to clear itself. Our hardware automatically removes the stimulus, so we have one other thing to clear. Bit 7 of the Control Register was set by the input pulse on the CD input, and will remain set until the port is read (label EXIT). Note that although we read that port, this value is not used. The service routine is finally terminated with RTI, and (in this case) operation in the loop SPIN is resumed. Note that almost any other operation could take the place of this loop, but this is a simple example, so feel free to improvise.

We didn't get to the real world interfaces I promised last time, so we'll try again next time. This has been a learning series, preparing for "greater things", so any of you who have just joined us may have to review earlier columns for background. Let's move on and do more complex and comprehensive interfacing!

**MICRO™**

Please forward questions and suggestions for discussion topics to Mr. Tenny at P.O. Box 545, Richardson, TX 75080.

### Listing

```

* THIS PROGRAM WILL INPUT AN 8-BIT VALUE ON THE
* COLOR COMPUTER SERIAL PORT IN RESPONSE TO
* AN INTERRUPT ON THE CD INPUT.
* EQUATES
010F FIRQ EQU $10F FIRQ INTERRUPT VECTOR
00AB DVAL EQU $AB DELAY VALUE
0095 BAUD EQU $95 BUFFER FOR DELAY CONSTANT
A000 POLCAT EQU $A000 KEYBOARD SCAN
FF20 PORTOUT EQU $FF20 RS232 OUT PORT
FF21 CTLIN EQU $FF21 CONTROL PORT FOR SERIAL IN
FF22 PORTIN EQU $FF22 SERIAL IN PORT
* MAIN PROGRAM
3000 ORG $3000
3000 7F 305D START CLR BUFR CLEAN SLATE
3003 8E 00AB LDX #DVAL SET UP TIMER
3006 9F 95 STX BAUD
3008 10BE 305E LDY #BUFR+1 POINT TO RECORD BUFFER
300C B6 FF21 LDA CTLIN ENABLE CD INTERRUPT
300F BA 01 ORA #1
3011 B7 FF21 STA CTLIN
3014 BE 302A LDX #INTSRV RESET FIRQ VECTOR
3017 BF 0110 STX FIRQ+1
301A B6 FF20 LDA PORTOUT RESET IRQ FLAG
301D 1C BF ANDCC #$BF ENABLE FIRQ INTERRUPT
301F AD 9F A000 SPIN JSR [POLCAT] TEST KEYBOARD
3023 26 30 BNE QUIT -
3025 B6 FF20 LDA PORTOUT RESET IRQ FLAG
3028 20 F5 BRA SPIN LOOP WAITING FOR INTERRUPT
302A 9E 95 INTSRV LDX BAUD GET DELAY VALUE
302C 1F 10 TFR X,D DIVIDE BY TWO
302E 47 ASRA
302F 56 RORB
3030 1F 01 TFR D,X
3032 8D 24 BSR DELAY AND COUNT IT DOWN
3034 B6 FF22 LDA PORTIN START BIT?
3037 84 01 ANDA #1
3039 26 16 BNE EXIT IF NOT, SKIP IT
303B 9E 95 LDX BAUD OTHERWISE, GET FULL DELAY TO
303D 8D 19 BSR DELAY READ MIDDLE OF FIRST BIT
303F C6 0B SETUP LDB #B BIT COUNT
3041 B6 FF22 INPUT LDA PORTIN READ PORT
3044 A7 A0 STA ,Y+
3046 44 LSRA
3047 76 305D ROR BUFR BIT INTO STORAGE
304A 9E 95 LDX BAUD SET UP TIMER
304C 8D 0A BSR DELAY
304E 5A DECB COUNT DOWN BITS
304F 26 F0 BNE INPUT AND DO EIGHT PASSES
3051 B6 FF20 EXIT LDA PORTOUT RESET IRQ FLAG
3054 38 RTI RETURN TO WAIT LOOP
3055 1A 40 QUIT ORCC #$40 DISABLE INTERRUPT
3057 39 RTS AND THEN QUIT
3058 30 1F DELAY LEAX -1,X
305A 26 FC BNE DELAY
305C 39 RTS
305D BUFR RMB 1
END

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# Next Month in Micro

Last month in "Next Month in MICRO" we promised you articles detailing how to define your own character sets on the new Epson FX-80 printer for the Commodore 64, VIC-20,

and Atari systems. Due to a lack of time and space, this material was not presented this month. It will, however, be presented in the next issue, and will include programs in BASIC to define the special characters on your display, to send the appropriate information to the FX-80 to define the characters, and to output BASIC listings. Some of the routines developed for the article were used to generate listings in this issue.

The main feature topic for January is Communications. One of the areas of microcomputer usage which is really expanding is that of telecommunication. There are literally hundreds of "bulletin boards", "tele-services", and so forth for you to talk to. MICRO is developing on its own hardware/software system, The MICRO Program Dump, that will allow subscribers to "download" programs that are published in MICRO directly into their microcomputers. The feature article Transfer Programs Over the Telephone will help your micro tie into the MICRO Program Dump. A second feature will be on Local Networks, a form of communication that allows you to interconnect various system components such as microcomputers, printers, storage devices and so forth. A third article will be about Using the VIC/C64 Parallel Port, providing cabling information and a program for transferring information via this useful, but not well supported, device.



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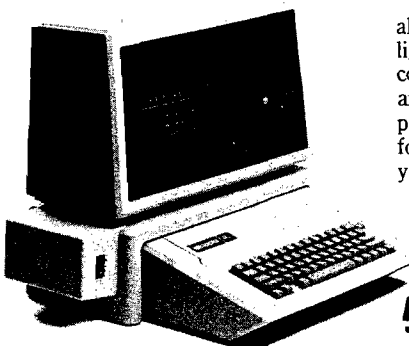
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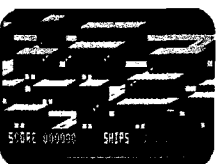
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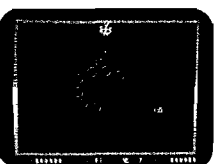
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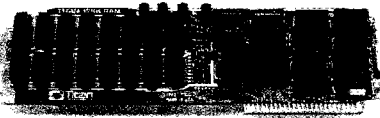
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