

How To Buy The Right Printer

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The Leading Magazine Of Home, Educational, And Recreational Computing

**Using Printers
With The TI-99/4A
And The TRS-80
Color Computer**

**Astrostorm,
Hawkmen Of Dindrin,
And More**

Ready To Run Game
Programs For VIC-20,
64, Atari, Apple, And
TI-99/4A

**Atari Player
Missiles Simplified:
A Tutorial
Approach**

**MusicMaster
For Commodore 64**

**Structured BASIC
For The TI-99/4A**



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TI
PN/64
C

V/AT/TI/AP
V/AT/64
V/AT/C
64/V/P/AT/TI/AP
64

64
AP
AT
V/64
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V/P
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AT
V
P
AT
64
V/64/AP/P
C

AP Apple, AT Atari, P PET/CBM, V VIC-20, O OSI, C Radio Shack Color Computer, 64 Commodore 64, S/T Sinclair ZX-81, TI Texas Instruments, *All or several of the above.

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Printing Atari Character Sets

Many of your game programs use a redefined character set, but access it by means of a POKE. What a headache! Is there any way on the 800 to change the ATASCII character set so that it can be accessed by PRINT statements?

Howard Fishman

It is possible to use strings to hold a redefined character set. We prefer the POKE method, however, because it is the easier one to type into the computer. Using strings would require the entry of quite long strings, filled with strange characters.

Genealogy

Recently I attended my first Computer Genealogy meeting and saw the program "Roots," used in building a family tree. Unfortunately, this program is not available for Commodore PETs.

I'm looking for a comparable program (price and capability-wise) that will run on a 32K PET. Any suggestions?

By the way, I noticed Genealogy (tracing your family back for generations) and Refunding (mailing in box tops and labels for cash, which I do) were two items not mentioned in the December '82 issue "How **COMPUTE!** Readers Use Their Computers" (pg. 30). So there's two more to add to that list!

Rita M. Thrasher

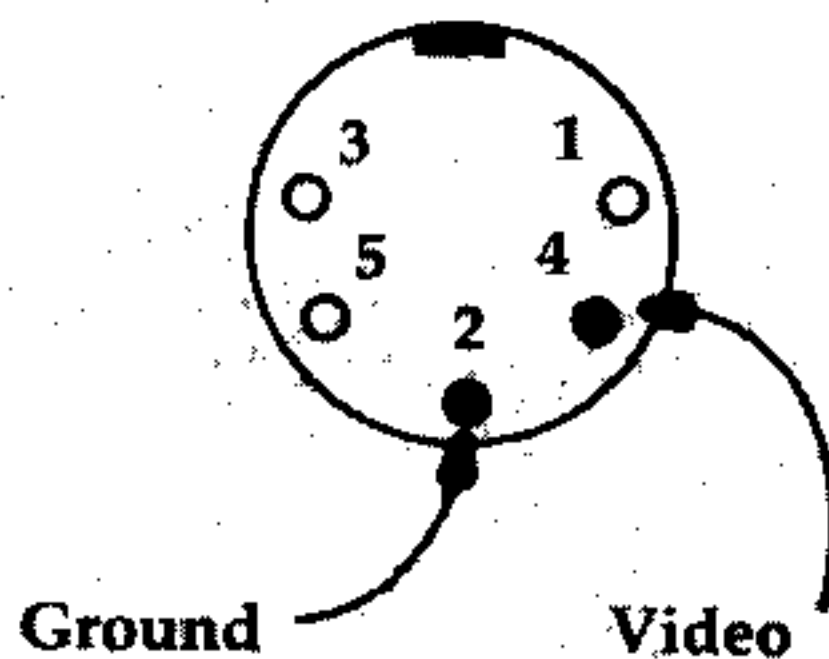
TI Monitor Connection

Can you help me? Our school has recently purchased 8 Texas Instruments TI-99/4A microcomputers. Among the 8 donated black and white television sets was a Hitachi monitor used with an Apple computer.

Can I hook up the Hitachi monitor to the TI? If so, how?

George S. Ruff

TI-99/4A Video Connector



Although the TI video output is a color signal, an acceptable black and white monitor picture can be obtained by taking the two signals shown in the figure below to the monitor input. The figure shows the video connector as you would see it facing the back panel of the TI-99/4A,

or the back side of an easily-obtainable five-pin DIN plug which plugs into the connector. Use shielded cable with the shielding braid connected to the GROUND pin. For the other end of the cable use whatever type of plug mates with your monitor's input jack.

Atari 400 Upgrade

In your December 1982, Issue 31, someone inquired about the flaws in the operating system of the 400/800 computers. I have an Atari 400 with the old operating system. Is there any way for me to get the new OS (revision B)? or is there any way to upgrade the existing ROM?

Rocky Boniello

No officially supported OS upgrade is offered by Atari, but you might contact your local Atari Service Representative. The ROMs are not on a removable board in your 400, so it is even harder to upgrade.

Understandable POKES

I have only had my Commodore 64 for a month, and I'm already becoming a fanatic.

I have a problem which I'm sure others have, and I also would like to propose a solution.

Most BASIC language programs can be followed with little difficulty, except for the POKE and PEEK statements. Without knowledge of each computer, one cannot follow or use the programs submitted in your magazine.

My solution is to use REM statements with each POKE or PEEK. For example, if I submitted a Commodore 64 program and had a statement such as

```
110 POKE 53281,1
```

many would not understand it. However,

```
110 POKE 53281,1:REM**SET BACKGROUND  
COLOR TO WHITE**
```

would assist people, since they could then use the appropriate commands or memory location to accomplish this on their computer!

Don Hollingsworth

This sounds like an excellent idea. Some complicated programs use POKES and PEEKs too often for this to be practical. However, many programs PEEK or POKE only a few times and such REM statements would be of real value to owners of other computers.

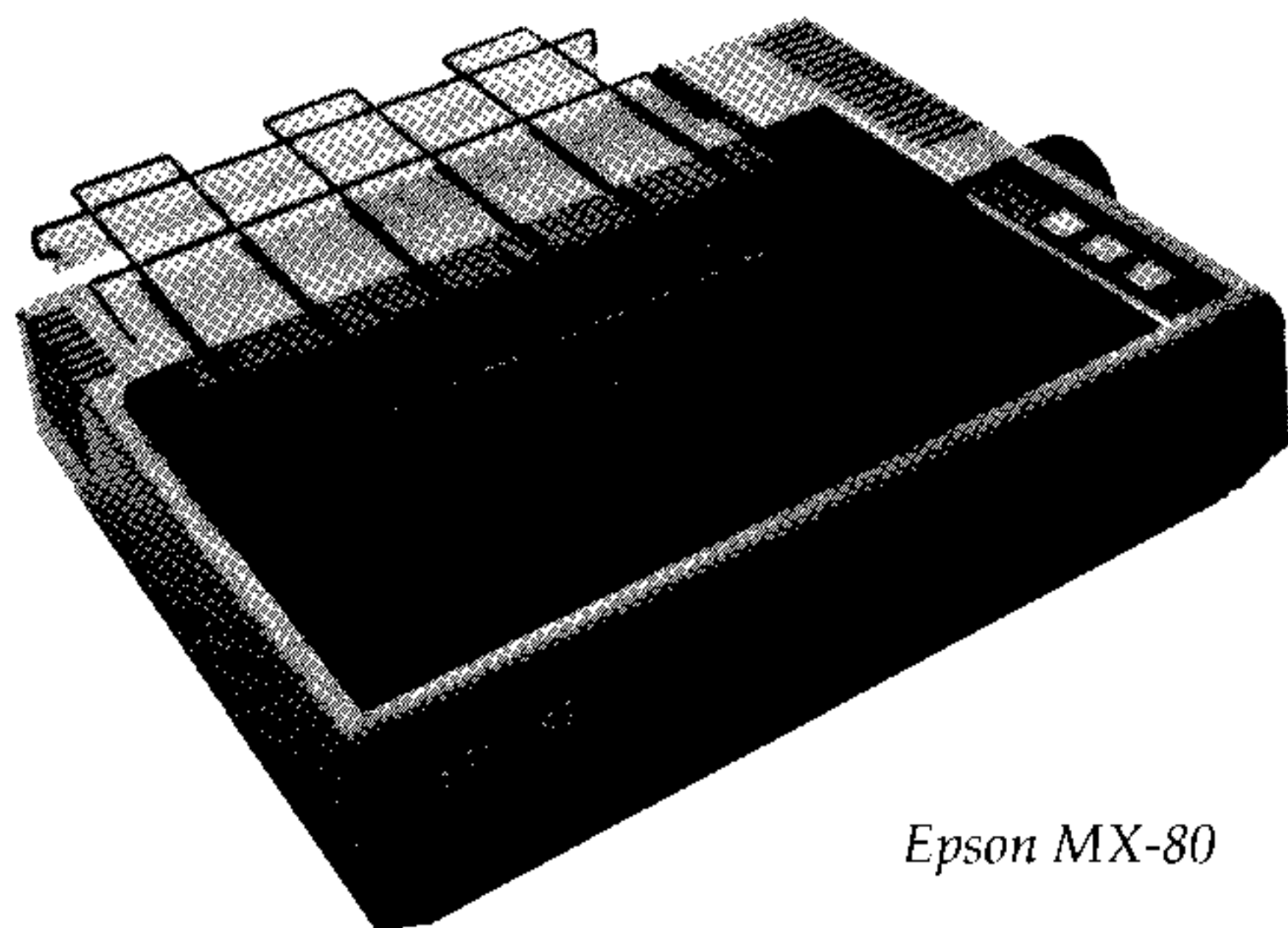
COMPUTE! welcomes questions, comments, or solutions to issues raised in this column. Write to: Readers' Feedback, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403. **COMPUTE!** reserves the right to edit or abridge published letters.



is not a problem in most cases; several computer manufacturers offer snap-on tractors at a fairly low cost. Nor is altering your interface capability generally much of a problem.

Many Choices

In the following printer descriptions, we will describe the specifications and special features of each machine. This should help you to compare these models to your needs and budget.



Epson MX-80

Epson MX-80

Of the Epson models in the MX Series, the MX-80 falls in our price category, retailing at \$494.

One standard feature of the MX Series is Graftrax Plus. Epson has upgraded this graphics chip from the original Graftrax included in earlier Epsons; the chip can be added to an older model. Graftrax Plus provides a considerable variety of graphics capabilities. It allows graphics configurations of up to 120 dots per inch horizontally and 72 dots per inch vertically. It also has an italics set and 66 possible variations of print characters, if you count all of the script variations.

The MX-80 can print a full 96-character ASCII set in upper- and lowercase. Characters are formed in its standard 9 x 9 matrix, though that can be emphasized and even double emphasized in a 9 x 18 or 18 x 18 matrix. Characters per inch (cpi) range from 5 to 17.16, depending on which mode you're using, and characters per line (cpl) run from 40 to 132. The print head operates bidirectionally at a speed of 80 characters per second (cps).

You can hook up an Epson MX-80 to several different models of home computers via its Centronics parallel interface. A one-line buffer is standard, but the optional RS-232 interface comes with a 2K buffer. An IEEE488 interface is also available. The adjustable, tractor-type pin feed will accommodate up to 10-inch fanfold paper.

*Epson America, Inc.
3415 Kashiwa Street
Torrance, CA 90505*

Radio Shack TRS-80 DMP-100 Dot-Matrix Printer

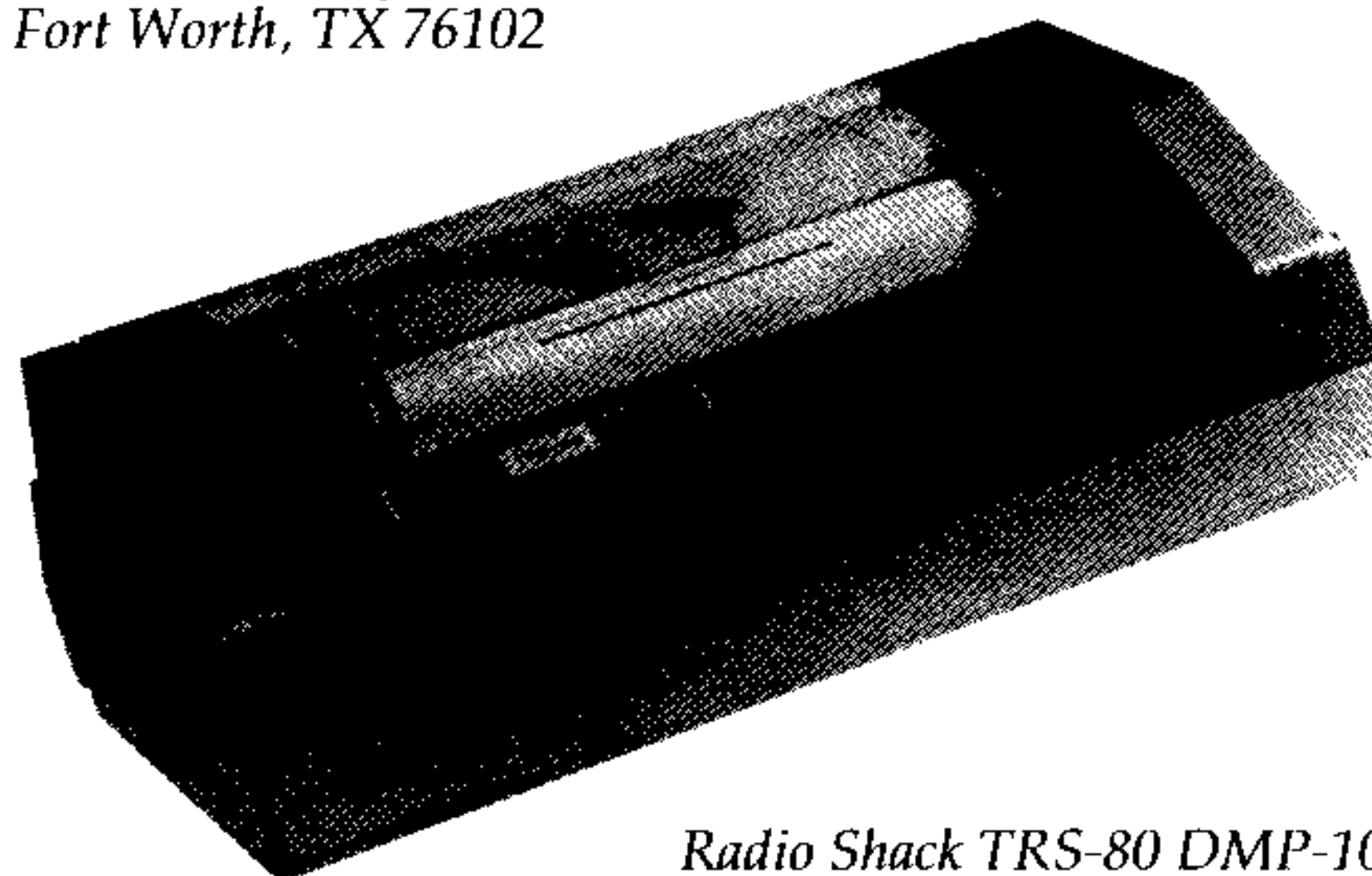
In December 1982, Radio Shack added a low-cost, dot-matrix printer to the growing list of TRS-80 microcomputer peripherals. Though Radio Shack has manufactured several printers for use with its personal computers, this is its first entry in the under-\$500 bracket.

The DMP-100's ability to print high-density, dot-addressable graphics is valuable for anyone interested in producing graphics on paper. Also, using an optional screen print program, the DMP-100 can produce detailed black and white graphics printouts similar to those on the TRS-80 Color Computer screen display. Its main character set can be expanded from 10 cpi to 5 cpi to create more readable copy.

The DMP-100's 80 upper- and lowercase 5 x 7 dot-matrix characters can be printed at a speed of 50 cpi. It has underline capacity and will take paper up to 9.5 inches wide. A buffer of 480 bytes is included with the printer, as is one ribbon cartridge. Selectable serial and parallel interfaces may be used to connect the DMP-100 to your Radio Shack computer.

The DMP-100 retails for \$499.

*Tandy Corporation
1800 One Tandy Center
Fort Worth, TX 76102*



Radio Shack TRS-80 DMP-100

Printelelex

About 2 inches high, 4 inches wide, and 8 inches long, the Printelelex manages to pack many features into that small space. It retails for \$145.

The Printelelex will not print on full-size paper. Its maximum paper width is 4.3 inches. And it's not an impact printer – it's *thermal*, so, although you won't have the noise of an impact printer, your paper costs will be higher.

The Printelelex prints characters in a 5 x 7 dot matrix at the rate of 160 cps. It prints a standard 10 cpi for a maximum of 40 cpl. It prints graphics. It prints upper- and lowercase characters. It is not logic-seeking, but it does have a one-line buffer. Both right and left margins can be justified.

The Printelelex has both a Centronics parallel

Using A Printer With The TI-99/4A

C. Regena

These tips will give you a good start on adding a printer to the TI-99/4A. Here are the fundamentals from the RS-232 Interface to PRINT # statements.

Texas Instruments has a thermal printer which attaches to the side of the TI. It is a small unit which uses a special thermal printer paper and can print a 30-column line. A number of other printers may also be used with your TI. Prices range from about \$500 on up. The cost depends on whether the printing is dot-matrix or letter quality, on various options available, and on how the printer is built. (For definitions of these terms, see other articles in this issue.)

To connect your printer to your TI-99/4A, you will need the RS-232 Interface. You may use either the "old-style" individual RS-232 Interface peripheral or the RS-232 Interface Card which fits in the TI Peripheral Expansion Box. You will also need a cable to go from the interface to the printer, and the cable should be sold with the printer. If you want to wire your own cable, the plug is a standard DB-25, and the pin connections are given in the manual that comes with the RS-232 Interface.

Configurations

Manuals are important. The manual that comes with the RS-232 Interface describes how you list parameters for your "printer configuration" so you can give instructions to your computer to access the printer through the RS-232. The manual that comes with the printer should describe how to achieve various type styles (fonts) and how to set margins, line lengths, and the top of the form. Be prepared to spend some time experimenting with the different switches and features of your printer.

When you use the printer configuration in a command, it is set off in quotes. Parameters may be chosen for baud rate, stop bits, and number of nulls. Some examples are:

```
"RS232.TW.BA = 110" (teletype)
"RS232.BA = 600" (TI 825 or TI 840 printer)
"RS232.BA = 9600.DA = 8" (Epson MX 80)
```

One of the primary uses of a printer is to obtain a "hard copy" listing of a program. Using your own printer configuration in the quotes, the following commands may be used:

```
LIST "RS232.BA = 600"
  Lists whole program
LIST "RS232.BA = 600": -250
  Lists program lines up to line 250
LIST "RS232.BA = 600":300-330
  Lists program lines 300 to 330
LIST "RS232.BA = 600":700-
  Lists program from line 700 to end
```

Another valuable use for a printer is to print a report from your program. Before you print, an OPEN statement is necessary. The OPEN statement designates a device number and your printer configuration. You may have several devices, and you may number your devices in any order. An example statement is:

```
120 OPEN #1:"RS232.BA = 600"
```

After the OPEN statement, you may print to the printer by a statement such as:

```
130 PRINT #1:"MY NAME IS REGENA."
```

When you've finished printing or you're at the end of the program, you should close all devices. This can be done with the following statement:

```
550 CLOSE #1
```

Here is a short sample program that illustrates printing to a printer:

```
100 OPEN #1:"RS232.BA = 600"
  Opens device #1 for printer.
110 OPEN #2:"SPEECH",OUTPUT
  Opens device #2 for speech (Terminal Emulator
  II required)
120 PRINT "HERE IS A SAMPLE."
  Prints message on screen.
130 PRINT #1:"TEST REPORT"
  Prints on printer.
```

140 PRINT #2:"HELLO"

Speaks the word using synthesizer.

150 CLOSE #1

Closes device #1.

160 CLOSE #2

Closes device #2.

170 END

The print list following the colon in a PRINT # statement follows the same rules as regular printing to the screen. Since the length of lines may be longer on the printer (the screen has 28 columns in a print line), you may use the TAB function to arrange your printing:

100 OPEN #1:"RS232.BA = 600"

110 PRINT #1:TAB(25):"MONTHLY PAYMENTS"

You may use a variable in the TAB function:

200 PRINT #1:TAB(T + A);MONTH\$;X

You may also use colons to print blank lines:

220 PRINT #1:::

If you have adjusted your printer properly for vertical tabs, you may go to the top of the next page by using:

300 PRINT #1:CHR\$(12)

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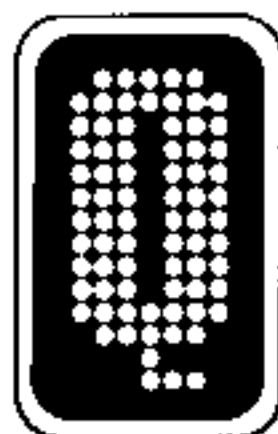
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Astrostorm

Peter Lear

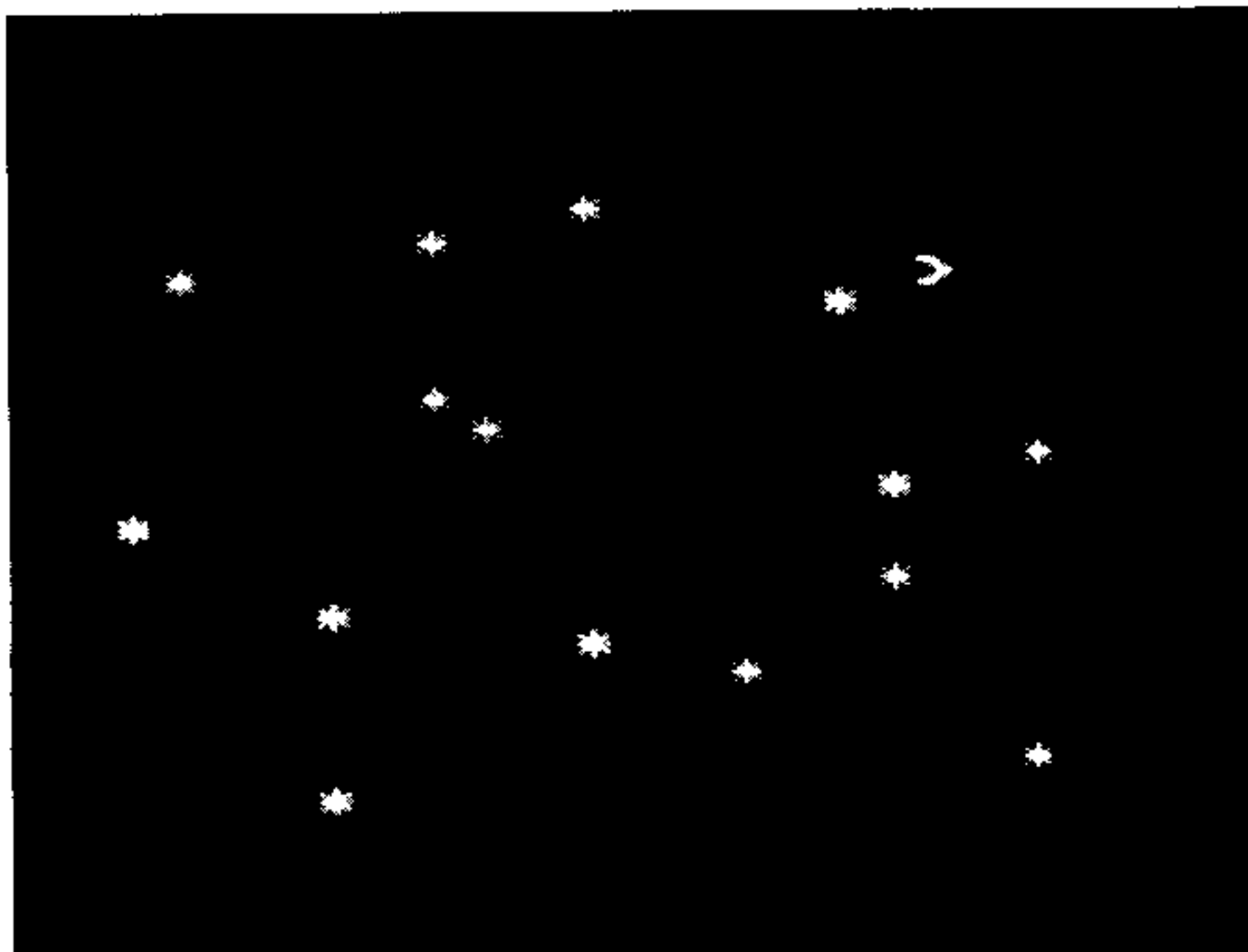
Try to guide your spaceship, carrying emergency medical supplies, through a dangerous asteroid storm. A great deal depends on your skills as a navigator. Many times the success or failure of your mission will depend on your ability to make split-second decisions under pressure. Versions for the VIC, Atari, TI-99/4A, and Apple.

The mission: you are Captain Bosdiger of the interstellar tug *The Viccard*. While orbiting the fifth planet in the Benard system, you receive a distress call. The call comes from the Solarian system, in need of vital medical supplies. You are to pick them up from the sixth planet in the Benard system and then take them to the third planet in the Solarian system.

There is a time factor. The drugs have a short life. Your calculations indicate that it will be necessary to drop out of hyperspace between the fourth and fifth planets' orbits. There you will be in an asteroid field. You must cross this field in less than two minutes.

Looking At Astrostorm

How does the VIC version work? Let's take a look.



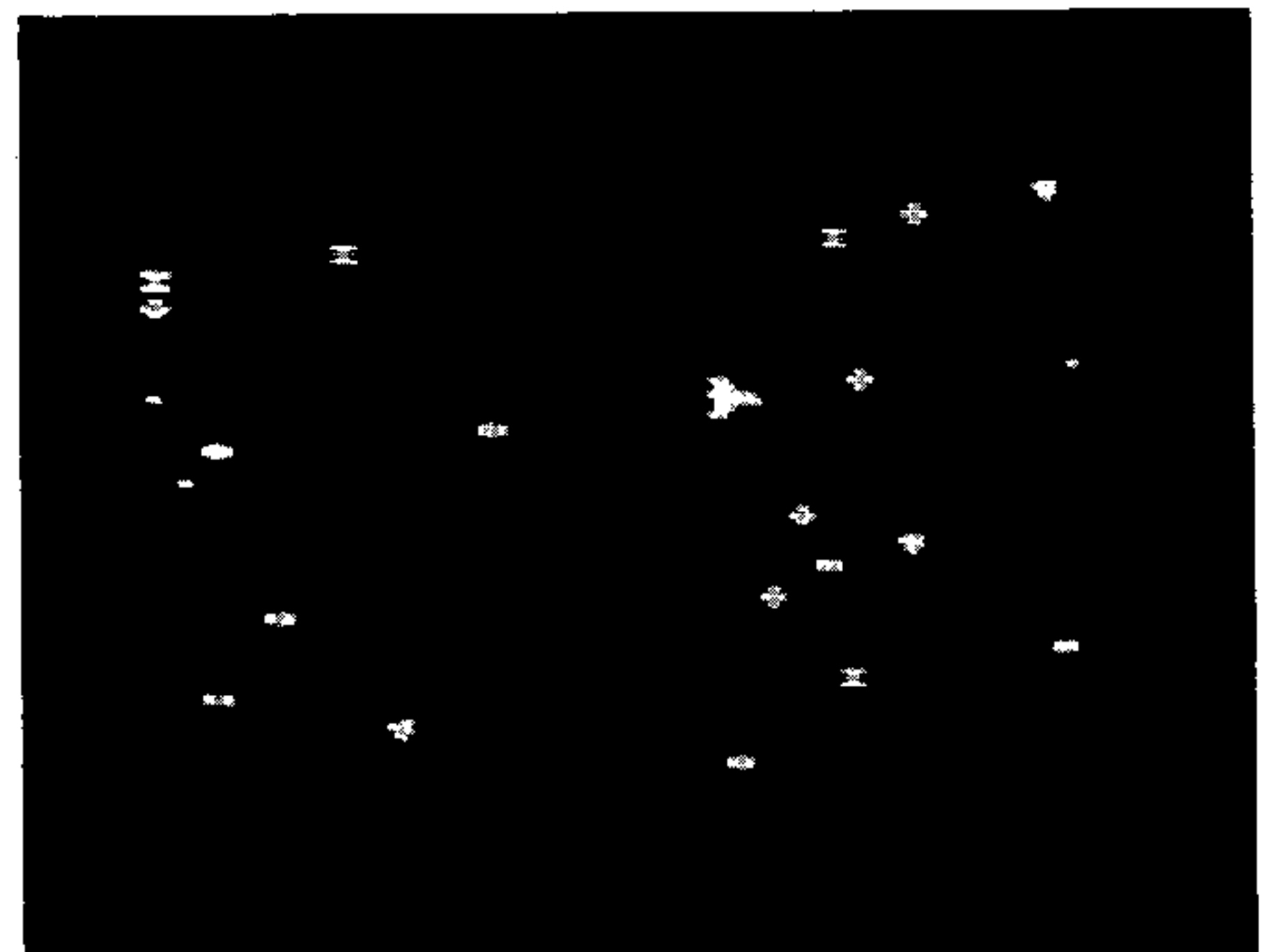
The player's spaceship (upper right) successfully negotiates the moving asteroids in "Astrostorm," VIC-20 version. (Apple and TI versions similar.)

In lines 5-230 the screen border is chosen and several variables for the joystick are defined. The player is given the choice of using a joystick or the keyboard. If you choose to use the keyboard, control the movement of the ship with the "Z" (left) or "C" (right) keys. The *VIC Programmers' Reference Guide* helped provide the joystick information necessary to use the first data statement.

Then we are sent zooming up to line 5000 to make a bit of noise. Some more data is used here. Now we are off to line 910 to ask for the "asteroid depth" that is required. This simply determines where the ship is to be located on the screen. It can be placed between the fifth and eighteenth rows (always starting on the left side).

Line 1030 makes the program versatile enough to use with any VIC-20. For example, initially the VIC starts its screen memory at location 7680. When an extra 8K or more is added, the start of screen memory changes to location 4096. Since 3K cartridges do not change this location, any cartridges can remain inserted.

The game's main playing loop is in lines 2000-2240. It is enclosed in a FOR/NEXT loop and timed for two minutes. All it does is decide on a random color and column for the asteroid. The galactic or solarian credits are based on the position and



A player's spaceship dodges space debris in the Atari version of "Astrostorm."

color of the asteroid. The alarm sound is created by turning voice 36875 on and off with the variable CK. The first two IFs in the game loop check to see if the screen has been crossed. When the ship is moving forward, you gain points; going backward (left), you lose points. And if there is no movement, there is no loss or gain.

The movement of the asteroids is created by scrolling them off the screen. The ship is POKEd on the screen. To prevent the ship from scrolling off every move, the program jumps to line 520. Here, with the variable OP (for old position), the

would-be scrolled ships are erased.

A check is made for every move to see if the ship has been hit. When this occurs, the program goes to 8170 to explode the ship. This is where the rest of the data is utilized. It then returns and offers a change in asteroid depth (this option is available for only seven seconds). Then an asteroid field is displayed in motion until either the fire button on the joystick or the keyboard's "H" key is pressed. To add to the excitement, you can think of this as dropping out of hyperspace.

Atari, TI-99/4A, And Apple Version Notes

Patrick Parrish, Programming Assistant

Atari Notes

The object of the Atari version of Astrostorm is to move your spaceship to the right across the asteroid field six times. The game is played with the keyboard or the joystick (in controller jack #1). In either case, movement of the spaceship is strictly horizontal. Once you start the spaceship moving left or right on the screen, it will continue until you cause a direction change.

With the joystick, left and right movement of the stick causes the spaceship to fly across the screen in the corresponding direction. Shifting the joystick position up or down will halt the spaceship. Under keyboard control, the "<" and ">" keys are used for left and right movement, and again, movement is continuous. If you choose the keyboard option, the spaceship's flight can be halted by pressing any key other than the "<" or ">" keys.

To achieve a high score on Astrostorm, avoid moving the spaceship to the left whenever possible, since penalty points are then deducted from your total. But bonus points are given for spaceship movement to the right. As an added incentive, you are awarded a thousand points each time you successfully maneuver the spaceship across the asteroid field.

TI-99/4A Notes

The object of Astrostorm on the TI-99/4A is to advance your spaceship across the asteroid field twelve times. Asteroids scroll from the bottom of the screen. Spaceship movement is horizontal. Control the movement of the ship by pressing the "<" and ">" keys.

This version of the game can be quite challenging since there are several skill levels. As the game begins, the vertical position of the spaceship can be set nearer the bottom of

the screen by specifying a greater "asteroid depth." A greater asteroid depth, of course, requires a faster reaction time. The difficulty of the game can be further increased by requesting a higher asteroid density (difficulty level).

The game loop (lines 500-830) is set to execute 1000 times. This means that you must finish your journey across the asteroid field before this loop is completed. You may find that this time limit is either too easy or too difficult, depending on the skill levels you choose. If so, vary the limit in line 500 as you see fit.

To achieve a high score on Astrostorm, avoid moving your spaceship backwards since points are deducted from your total.

Apple Notes

With the Apple version of Astrostorm, you must move the spaceship across the astrofield six times to win. There is no time limit, and the game loop (lines 120-250) will execute until a crash is detected (line 230).

Asteroids scroll from the bottom of the screen. Only horizontal movement of the spaceship is allowed by the program. Movement, which is continuous, is accomplished with the SPACE bar while direction is controlled with the left and right arrow keys.

There are several skill levels. You can make the game more difficult by specifying a higher asteroid depth. This will place the spaceship closer to the bottom of the screen, and consequently, require a quicker reaction on your part to avoid a collision.

Scoring is based on the direction of spaceship movement and difficulty level. Of course, more points are given at greater asteroid depths. Points are awarded for movement of the spaceship to the right and deducted for movement to the left.


```

40 FOR I=PMBASE+512 TO PMBASE+640:PO
KE I,0:NEXT I
50 POKE 53248,X
60 POKE 704,216:P0=PMBASE+512+Y
70 FOR I=PMBASE+512+Y TO PMBASE+517+
Y:READ A:POKE I,A:NEXT I
80 DATA 224,112,254,127,112,224
95 POKE 53278,0
97 IF R=2 THEN 500
104 B=STICK(0):IF B<>15 THEN A=B
110 X=X-4*(A=11)+4*(A=7):POKE 53248,
X:PT=PT+10-25*(A=11)
130 IF PEEK(53252) THEN POKE 764,255
:GOTO 2000
140 IF X>200 THEN POKE 53248,60:W=W+
1:PT=PT+1000:X=60
145 IF X<60 THEN POKE 53248,200:X=20
0:PT=PT-1000
150 IF W=6 THEN 1000
190 POSITION 17*(RND(0)*2)+4,23:Z=IN
T(LEN(N$)*RND(0)+1):? N$(Z,Z):PO
KE 710,PEEK(53770)
260 GOTO 97
500 I=PEEK(764)
520 IF I=54 THEN X=X-4:POKE 53248,X:
PT=PT-15:GOTO 130
530 IF I=55 THEN X=X+4:POKE 53248,X:
PT=PT+10:GOTO 130
540 GOTO 190
1000 POKE 764,255:GOSUB 2100:GRAPHIC
S 0:ON W GOTO 2000,1200,1005,10
05,1005,1020,1010
1005 IF W<6 THEN GRAPHICS 0:? "You d
id not complete your mission.":
GOTO 1020
1010 ? :? CHR$(125);"You completed y
our mission."
1020 ? "The Solarian System Minister
has":? "awarded you ";PT;" Sol
arian"
1025 ? "credits for your services.":
GOTO 2010
1200 ? CHR$(125);"The Solarian Gover
nment has fined":? "you ";PT;"
galactic credits."
1210 ? :? "but, they also have anothe
r mission":? "for you!":GOTO 2
010
2000 FOR W=15 TO 0 STEP -.3:SOUND 0
,20*RND(0),0,W:POKE 704,PEEK(53
770):POKE P0+6*RND(0),PEEK(5377
0):NEXT W
2005 GRAPHICS 0:? "You didn't make i
t. The Solarian":? "government
has sent your family ":? PT;" g
alactic credits."
2010 GOSUB 2100:POKE 764,255:? "Play
again? (Y/N)":? :GET #1,A:IF A<
>ASC("N") THEN RUN
2020 GRAPHICS 0:GOSUB 2100:END
2100 POKE 53277,0:POKE 53248,0:RETUR
N
3000 GRAPHICS 0:SETCOLOR 2,6,6
3010 ? "{2 TAB}ASTROSTORM"
3030 ? :? "1. Joystick":? :? "2. Key
board":? "{3 SPACES}Use < and >
for move"
3040 OPEN #1,4,0,"K:":? :? "Select:"
;
3050 GET #1,A:R=A-48:IF R<1 OR R>2 T
HEN 3050
3080 RETURN
3100 END

```

Program 3: TI-99/4A Version

```

100 RANDOMIZE
110 CALL CLEAR
120 FOR I=5 TO 8
130 CALL COLOR(I,16,1)
140 NEXT I
150 CALL CLEAR
160 PRINT " A S T R O S T O R M !!!
"
170 PRINT
180 PRINT
190 PRINT "POWER SHIP WITH < & > KE
YS"
200 FOR I=1 TO 9
210 PRINT
220 NEXT I
230 FOR I=14 TO 3 STEP -1
240 FOR J=1 TO 20
250 NEXT J
260 CALL SCREEN(I)
270 NEXT I
280 FOR I=1 TO 400
290 NEXT I
300 S=3
310 PT=0
320 RSHIP=10
330 CSHIP=1
340 SHIP=62
350 COL=2
360 RLSHIP=RSHIP
370 CLSHIP=CSHIP
380 CALL CLEAR
390 PRINT "WHAT ASTEROID DEPTH (1-1
0)";
400 INPUT X
410 IF (X>10)+(X<1)THEN 380
420 PRINT
430 PRINT "WHAT DIFFICULTY LEVEL (1
-10)"
440 INPUT DCULT
450 IF (DCULT>10)+(DCULT<1)THEN 380
460 CALL CLEAR
470 CALL SCREEN(S)
480 CALL COLOR(2,16,1)
490 REM VARY LIMIT OF LOOP IN THE N
EXT LINE IF THE GAME IS TOO HAR
D OR TOO EASY
500 FOR LOOP=1 TO 1000
510 FOR I=1 TO INT(RND*X)+1
520 COL=INT(RND*30)+2
530 CALL HCHAR(23,COL,42)
540 NEXT I
550 PRINT
560 CALL GCHAR(RSHIP+DCULT,CSHIP,LO
C)
570 CALL HCHAR(RLSHIP+DCULT-1,CLSHI
P,32)
580 IF LOC=42 THEN 1190
590 CALL SCREEN(S)
600 CALL HCHAR(RSHIP+DCULT,CSHIP,SH
IP)
610 CLSHIP=CSHIP
620 RLSHIP=RSHIP
630 CALL KEY(3,A,STATUS)
640 IF A<>ASC(".")THEN 730
650 CALL SOUND(-700,-5,3)
660 PT=PT+5*DCULT*X
670 CSHIP=CSHIP+1
680 IF CSHIP<>32 THEN 720
690 CSHIP=1
700 S=S+1
710 IF S=15 THEN 1030
720 SHIP=62

```

```

730 IF A<>ASC(",")THEN 820
740 CALL SOUND(-700,-6,4)
750 SHIP=60
760 PT=PT-8*DCULT*X
770 CSHIP=CSHIP-1
780 IF CSHIP<>1 THEN 810
790 CSHIP=32
800 S=S-SGN(S-3)
810 SHIP=60
820 REM
830 NEXT LOOP
840 CALL CLEAR
850 PRINT " YOU DID NOT COMPLETE YO
UR"
860 PRINT
870 PRINT "MISSION. THE SOLARIAN"
880 PRINT
890 PRINT "GOVERNMENT HAS FINED YOU
"
900 PRINT
910 PRINT PT;"GALACTIC CREDITS."
920 PRINT
930 PRINT
940 PRINT
950 PRINT " BUT, THEY ALSO HAVE "
960 PRINT
970 PRINT "ANOTHER MISSION FOR YOU!
!!"
980 PRINT
990 PRINT
1000 INPUT "ARE YOU GAME (Y OR N)?"
:G$
1010 IF G$="Y" THEN 300
1020 GOTO 1500
1030 REM YOU WIN!!
1040 CALL CLEAR
1050 PRINT " YOU COMPLETED YOUR "
1060 PRINT
1070 PRINT "MISSION. THE SOLARIAN M
INI-"
1080 PRINT
1090 PRINT "STER HAS AWARDED YOU ";
PT
1100 PRINT
1110 PRINT "SOLARIAN CREDITS FOR YO
UR "
1120 PRINT
1130 PRINT "SERVICES AND WISHES YOU
"
1140 PRINT
1150 PRINT "TO MAKE ANOTHER DELIVER
Y!"
1160 PRINT
1170 PRINT
1180 GOTO 980
1190 CALL SCREEN(12)
1200 FOR I=1 TO 50
1210 NEXT I
1220 CALL SCREEN(9)
1230 FOR VOL=24 TO 1 STEP 4
1240 CALL SOUND(200,-7,VOL)
1250 NEXT VOL
1260 FOR VOL=1 TO 24 STEP 4
1270 CALL SOUND(200,-7,VOL)
1280 NEXT VOL
1290 CALL SCREEN(12)
1300 FOR I=1 TO 10
1310 NEXT I
1320 CALL SCREEN(8)
1330 CALL CLEAR
1340 CALL SCREEN(6)
1350 PRINT "(4 SPACES)TOD BAD! THE
SOLARIAN"

```

```

1360 PRINT " GOVERNMENT HAS SENT YO
UR"
1370 PRINT " FAMILY ";PT;" GALACTIC "
1380 PRINT " CREDITS."
1390 FOR I=1 TO 5
1400 PRINT
1410 NEXT I
1420 PRINT "(3 SPACES)HIT -P- TO PL
AY AGAIN"
1430 PRINT " OR -S- TO STOP."
1440 FOR I=1 TO 5
1450 PRINT
1460 NEXT I
1470 CALL KEY(3,K,ST)
1480 IF ST=0 THEN 1470
1490 IF (K=ASC("C"))+(K=ASC("P"))TH
EN 300
1500 END

```

Program 4: Apple Version

```

10 REM ASTEROID FIELD - APPLE II VERS
ION
20 FOR I = 770 TO 795: READ M: POKE I,
M: NEXT I
25 DATA 172,01,03,174,01,03,169,04,32
,168,252,173,48,192,232,208,253,13
6,208,239,206,0,03,208,231,96
30 GOTO 1000
100 TEXT : HOME : VTAB 1: PRINT "SCORE
": POKE 34,2
110 FOR I = 1 TO 15:SP = INT ( RND (1
) * 39) + 2: VTAB 24: HTAB (SP): PRINT
"*": NEXT I
115 FOR I = 10 TO 50 STEP 40: POKE 768
,10: POKE 769,I: CALL 770: NEXT I
120 POKE 0P,160: VTAB 24:SP = INT ( RND
(1) * 39) + 2
130 HTAB (SP): PRINT "*"
140 IF PEEK (CP) = 170 THEN GOTO 800
145 POKE CP,CC:OP = CP
146 FOR I = 1 TO 25: NEXT
149 VTAB 1: HTAB 7: CALL - 868: VTAB
1: HTAB 7: PRINT PT
170 M = PEEK ( - 16384): ON M < 128 GOTO
120
180 IF M - 128 = 8 THEN CC = 188:MV =
- 1: GOTO 120
190 IF M - 128 = 21 THEN CC = 190:MV =
+ 1: GOTO 120
200 IF M - 128 < > 32 THEN GOTO 120
210 IF CP < > BP OR MV > 0 THEN GOTO
215
212 ON SF GOTO 120
213 CP = BP + 39:SF = SF - 1: GOTO 230
215 CP = CP + MV
220 IF CP < > BP + 39 THEN GOTO 230
222 ON SF = 6 GOTO 600
225 CP = BP:SF = SF + 1
230 IF PEEK (CP) = 170 THEN GOTO 800
240 IF NOT MV THEN PT = PT + INT ((M
V * ( INT (DL * .2) * ((CP - BP) *
SF))) / 2): GOTO 250
245 PT = PT + (MV * ( INT (DL * .3) * (
CP - BP) * SF)))
250 GOTO 120
600 REM WIN
610 TEXT : HOME : VTAB 2: HTAB 15: PRINT
"SCORE: ";PT
620 VTAB 8: HTAB 13: FLASH : PRINT "CO
NGRATULATIONS": NORMAL : VTAB 12: HTAB
14: PRINT "YOU MADE IT!"
640 POKE 768,15: POKE 769,50: CALL 770

```

Memory Trainer

Harvey B. Herman, Associate Editor

For 64, VIC, PET/CBM, Atari, TI, and Apple – this program might help you improve your memory skills. Some people, training in a similar fashion, have been able to quickly memorize random 80-digit numbers.

A provocative article, entitled "Exceptional Memory," appeared recently in *American Scientist* (vol. 70, no. 6, p. 607, 1982). The authors described experiments in which a person with a normal memory was trained to recall a sequence of over 80 random digits. How?

When most people read a random sequence once, they can remember only five to nine digits, the apparent limit of short-term memory (STM).

One might call this prodigious feat of memory (recalling 80 digits) *exceptional*, but the authors said that this skill may not be uncommon. Diligent practice, in one case 230 hours over 20 months, resulted in improvement in the ability to rapidly transfer information into long term memory (LTM). A "normal" memory could thereby be transformed into an "exceptional" one.

How easy it would be to automate the task of memory training by using a computer. Consequently, after reading the article, I sat down at my Commodore 8032 and wrote "Memory Trainer." Random digits are flashed on the screen at a specified rate, rather than being read to the subject. If the sequence is repeated correctly, the next sequence of digits is increased by one. When an error is made, the length of the sequence decreases by one. The subject can stop the experiment at any point, whereupon the maximum number length achieved is displayed.

Program 1: 80-Column CBM Version

```
100 REM MEMORY TRAINING PROGRAM
110 REM PATTERNED AFTER TECHNIQUE IN:
120 REM "EXCEPTIONAL MEMORY" BY
130 REM K.A. ERICSSON AND
140 REM W.G. CHASE
150 REM AMERICAN SCIENTIST
160 REM VOL 70, NO 6, PG 607, 1982.
170 REM
180 REM PROGRAM BY HARVEY B. HERMAN
190 REM
200 REM MAX 76 DIGITS
210 DIM N(76)
220 MA=0:REM MA=MAX CORRECT SCAN
230 PRINT "{CLEAR}{REV}MEMORY TRAINING PRO
GRAM"
```

```
240 PRINT
250 INPUT "DIGIT RATE (SEC/DIG) 1{03
LEFT}";DR
260 IF DR<.5 THEN DR=.5
270 PRINT
280 INPUT "INITIAL SEQUENCE LENGTH 5{03
LEFT}";SL
290 IF SL<2 THEN SL=2
300 IF SL>76 THEN SL=76
310 REM MIN DIGIT RATE .5 SEC/DIG
320 REM SEQ LEN - MIN 2:MAX 76
330 PRINT:PRINT"{REV}CURRENT DIGIT SPAN{
OFF}";SL;"{LEFT} "
340 REM FLASH GET SET AND DIGITS
350 PRINT:PRINT "{REV}GET SET{OFF}";:FOR I
=1 TO 300:NEXT I
360 PRINT "{07 LEFT}GET SET";CHR$(7):PRINT
"":PRINT "{UP}";:FOR I=1 TO 1250:
NEXT I:PRINT
370 FOR I=1 TO SL
380 N(I)=INT(RND(1)*10)
390 T=TI
400 PRINT "{UP}{REV}";N(I);"{OFF}";:FOR J=
1 TO 100:NEXT J
410 PRINT "{03 LEFT}";N(I)
420 IF TI<T+DR*60 THEN 420
430 NEXT I
440 PRINT "{UP} ";
450 PRINT:PRINT "INPUT DIGITS":FL=0
460 PRINT "
";
470 PRINT "
":INPUT "{02 UP} *{03
LEFT}";A$
480 IF LEN(A$)<>SL THEN FL=1:GOTO 540
490 FOR I=1 TO SL
500 IF VAL(MID$(A$,I,1)) <> N(I) THEN FL=1
:I=SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES SEQ L
EN BY ONE
530 REM FL=1 - INCORRECT - DECREASES SEQ L
EN BY ONE
540 PRINT:IF FL=1 THEN PRINT "{REV}INCORRE
CT{OFF} - TRY A SHORTER SPAN NEXT
":SL=SL-1
550 IF FL=1 THEN PRINT "
";
560 IF FL=1 THEN PRINT "
":PRINT "{ UP}";
570 IF FL=1 THEN FOR J=1 TO SL+1:PRINT RIG
HT$(STR$(N(J)),1);:NEXTJ:GOTO620
580 PRINT "{REV}CORRECT{OFF} - TRY A LON
GER SPAN NEXT ":SL=SL+1
590 IF MA<SL-1 THEN MA=SL-1
600 PRINT "
";
610 PRINT "
":PRINT "{UP}";
620 PRINT:PRINT:INPUT "AGAIN Y{03 LEFT}"
;N$:IF SL<1 THEN SL=1
```

```

290 IF SL < 2 THEN SL = 2
300 IF SL > 76 THEN SL = 76
320 REM SEQ LEN - MIN 2:MAX 76
330 PRINT : INVERSE : PRINT "CURRENT D
IGIT SPAN";: NORMAL : PRINT " ";SL
340 REM FLASH GET SET AND DIGITS
350 PRINT : FLASH : PRINT "GET SET";: FOR
I = 1 TO 300: NEXT I: NORMAL : HTAB
1: PRINT "GET SET";
360 PRINT CHR$(7): PRINT "*";: FOR I
= 1 TO 1250: NEXT I
370 FOR I = 1 TO SL
380 N(I) = INT ( RND (1) * 10)
400 HTAB 1: INVERSE : PRINT N(I);: FOR
J = 1 TO 100: NEXT J: NORMAL
410 HTAB 1: PRINT N(I);: IF I = SL THEN
HTAB 1: PRINT " ";
420 FOR K = 1 TO DR * 100: NEXT K
430 NEXT I
450 PRINT : PRINT : PRINT "INPUT DIGIT
S":FL = 0
460 PRINT "
";
470 PRINT "
": VTAB 13: PRINT "*";: HTAB
1: INPUT "":A$
480 IF LEN (A$) < > SL THEN FL = 1: GOTO
540
490 FOR I = 1 TO SL
500 IF VAL ( MID$ (A$,I,1)) < > N(I)
THEN FL = 1:I = SL
510 NEXT I
520 REM FL=0 - CORRECT - INCREASES SE
Q LEN BY ONE
530 REM FL=1 - INCORRECT - DECREASES
SEQ LEN BY ONE
540 IF FL = 1 THEN INVERSE : VTAB 15:
PRINT "INCORRECT";: NORMAL : PRINT
" - TRY A SHORTER SPAN NEXT ":SL =
SL - 1
550 IF FL = 1 THEN PRINT "
";
560 IF FL = 1 THEN PRINT "
": VTAB 1
6
570 IF FL = 1 THEN FOR J = 1 TO SL +
1: PRINT RIGHT$ ( STR$ (N(J)),1);
: NEXT J: GOTO 620
580 VTAB 15: INVERSE : PRINT "CORRECT"
;: NORMAL : PRINT " - TRY A LONGER
SPAN NEXT ":SL = SL + 1
590 IF MA < SL - 1 THEN MA = SL - 1
600 PRINT "
";
610 PRINT "
": VTAB 18
620 HTAB 1: VTAB 19: INPUT "AGAIN (Y O
R N) ? ":N$: VTAB 19: HTAB 18: PRINT
" ": IF SL < 1 THEN SL = 1
630 IF SL > 76 THEN SL = 76
640 IF LEFT$ (N$,1) = "Y" THEN VTAB
6: GOTO 330
650 PRINT : HTAB 7: PRINT "HOPE YOU IM
PROVED YOUR SPAN!": PRINT
660 HTAB 7: INVERSE : PRINT "HIGHEST C
ORRECT DIGIT SPAN";: NORMAL : PRINT
" ";MA: VTAB 23
130 MA=0
140 CALL CLEAR
150 CALL SCREEN(12)
160 FOR I=5 TO 8
170 CALL COLOR(I,14,16)
180 NEXT I
190 PRINT "(6 SPACES)MEMORY TRAINER
"
200 FOR I=1 TO 3
210 PRINT
220 NEXT I
230 INPUT "DIGIT RATE (1-10) ? ":DR
240 IF DR<1 OR DR>10 THEN 140
250 PRINT
260 INPUT "INITIAL SEQUENCE LENGTH
? ":SL
270 IF SL<2 THEN SL=2
280 IF SL>90 THEN SL=90
290 PRINT
300 PRINT
310 PRINT
320 PRINT "CURRENT DIGIT SPAN "&STR
$(SL)
330 PRINT
340 PRINT
350 IF H$<>"Y" THEN 390
360 FOR I=1 TO 6
370 PRINT
380 NEXT I
390 PRINT "get set"
400 PRINT "*"
410 FOR I=9 TO 11
420 CALL COLOR(I,10,7)
430 NEXT I
440 FOR I=1 TO 200
450 NEXT I
460 FOR I=9 TO 11
470 CALL COLOR(I,2,1)
480 NEXT I
490 CALL SOUND(150,300,10)
500 FOR I=1 TO 200
510 NEXT I
520 FOR I=1 TO SL
530 N(I)=INT(RND*10)
540 CALL HCHAR(23,3,N(I)+48)
550 FOR J=1 TO DR*20
560 NEXT J
570 CALL HCHAR(23,3,32)
580 FOR K=1 TO 10
590 NEXT K
600 NEXT I
610 CALL HCHAR(23,3,32)
620 FL=0
630 PRINT
640 PRINT
650 IF H$<>"Y" THEN 690
660 FOR I=1 TO 4
670 PRINT
680 NEXT I
690 PRINT "INPUT DIGITS"
700 INPUT "":A$
710 PRINT
720 PRINT
730 FOR I=1 TO 200
740 NEXT I
750 IF LEN(A$)=SL THEN 780
760 FL=1
770 GOTO 850
780 FOR I=1 TO SL
790 IF VAL(SEG$(A$,I,1))=N(I) THEN 8
20
800 I=SL
810 FL=1

```

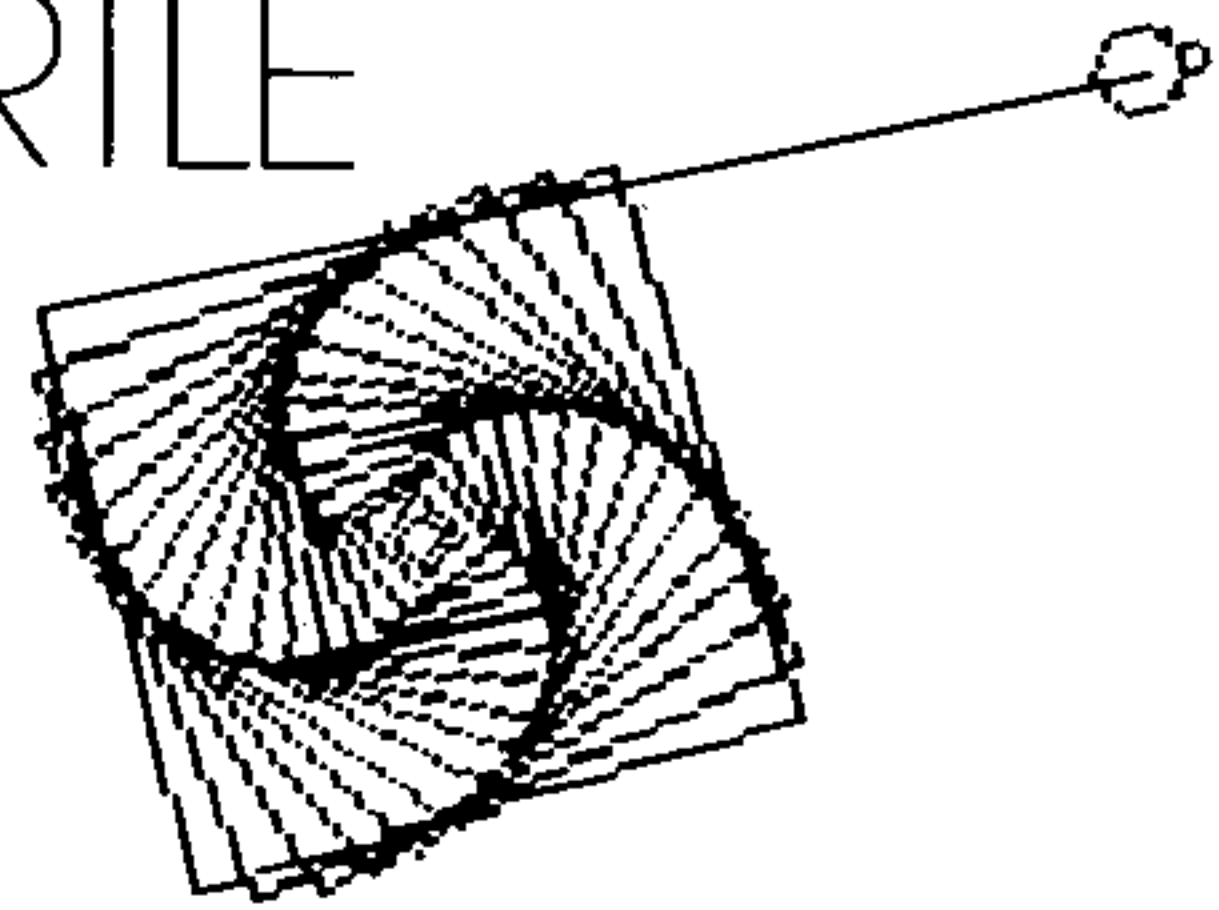
Program 6: TI-99/4A Version

```

100 RANDOMIZE
110 REM MAX 90 DIGITS
120 DIM N(90)

```

FRIENDS OF THE TURTLE



David D. Thornburg, Associate Editor

HES Turtle Graphics II

I visited with the people from HES at their booth at the Las Vegas Consumer Electronics Show this January. At that time I was given a glimpse of Turtle Graphics II, a graphics language they developed for the Commodore 64. I was pleased by what I saw, and even more pleased when a preliminary copy of the language was sent for me to review.

HES Turtle Graphics II supports two kinds of display screens – the LORES, or text, screen, and the HIRES, or 320 x 200 pixel, color graphics screen. Furthermore, this language also supports the Commodore 64 sprite graphics.

The software package contains:

1. A program editor
2. A sprite shape editor
3. An I/O handler for disk, tape or printer, and
4. A trace mode

While Turtle Graphics II does not have a mode for the immediate execution of commands, the program editor is so easy to use that this is not a great drawback.

Syntactically, Turtle Graphics II is a cross between Atari PILOT and the turtle graphics portion of TI Logo. To illustrate this, I have created the listings below in Turtle Graphics II, Atari PILOT, and TI Logo. The listing is for a procedure that generates a squiral pattern similar to that used in the Friends of the Turtle emblem. To make the listings easier to compare, I have numbered all the lines and made sure that similar lines have similar numbers.

Before analyzing the Turtle Graphics II syntax in detail, you should compare the three listings. You can see that the HES language is intermediate between TI Logo and Atari PILOT. When you examine the syntax chosen for the HES sprite graphics, the relation to TI Logo is even more evident (for example, to start or stop sprite movement, you type FREEZE or THAW).

This is not to suggest that HES Turtle Graphics II is in any way a replacement for Logo. Logo has many features that just aren't available on other languages. But, if you want to explore turtle graphics on the Commodore 64, this language is a fine starting point.

HES Turtle Graphics II

```
1 LABEL SQUIRAL
2 HIRES
3 PEN UP
4 MOVE TO 100-160
5 SETHEADING TO 90
6 PEN DOWN
7 CALCULATE Y=0
8 LABEL ADD 2
9 CALCULATE Y=Y+2
10 FORWARD Y
11 ROTATE RIGHT 89
12 TEST IF (Y>180)
13 IF FALSE JUMP ADD 2
14 ROUTINE END
```

Atari PILOT

```
1 *SQUIRAL
2 GR: CLEAR
3 GR: PEN UP
4 GR: GOTO 0,0
5 GR: TURNT0 0
6 GR: PEN YELLOW
7 C: #Y=0
8 *ADD2
9 C: #Y=#Y+2
10 GR: DRAW #Y
11 GR: TURN 89
12
13 J (#Y<181): *ADD2
14 E:
```

TI Logo

```
1 TO SQUIRAL
2 TELL TURTLE CLEARSCREEN
3 PEN UP
4 SXY 0 0
5 SETHEADING 0
6 PEN DOWN
7 MAKE "Y 0
8 ADD2:
9 MAKE "Y:Y +2
10 FORWARD :Y
11 RIGHT 89
12 TEST Y > 180
13 IFF GO "ADD2
14 END
```

Nonstandard Features

Before leaving the listings, there are a few non-standard "features" that need to be mentioned. First, the HES turtle does not start in the middle of the screen; it starts in the upper left corner. Also, the MOVE TO command accepts the Y-axis (measured from 0 at the top) first, followed by the X-axis. I know of no other language that accepts coordinates in this sequence.

Two other nonstandard turtle characteristics involve the SETHEADING TO command. A heading of 0 degrees faces the turtle to the right (instead of straight up), and turning angles for this command increase in a counterclockwise (instead of clockwise) direction. The starting angle and starting position for the turtle make sense if you recall that the original turtle graphics package from these people used only the text display.

None of these characteristics is a show-stopper – as long as each is understood from the beginning.

There are many features of HES Turtle Graphics II that I find delightful. The sprite editor lets you easily create shapes, change their color and magnification, and save them on tape or disk for later use. The sprite editor contains eight predefined shapes that can be changed to anything you wish. The shapes provided include a boat, rocket, truck, ball, space shuttle, house, man,

and woman. Sprites can be made to wrap around the screen if so desired (this causes them to appear at the opposite edge of the screen if they are moved off one end). You can also set the speed and visibility of any sprite, and can even control a sprite's position directly with a joystick.

The program editor lets you enter two-letter abbreviations for all commands (for example, you can enter IT instead of IF TRUE JUMP). And yet, when the program is listed, all abbreviated words are fully expanded to their English counterparts.

While I am primarily interested in the high resolution graphics turtle, the low resolution (character-based) turtle graphics has some interesting features. One of the more powerful is the CHECK FOR command that looks for the existence of a chosen character directly ahead of the turtle. This command allows Turtle Graphics II users to create maze-solving programs.

Turtle Graphics II is a language worth considering if you are interested in turtle graphics, but don't need the rest of the power found in Logo.

Next Time

In the last few weeks, several people have asked me for a side-by-side comparison of PILOT and Logo. The result of such a comparison includes some surprises, as you will see next month. ©

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IT'S ABOUT TIME

by G. Herzenstiel

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by B. Belian



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PROGRAMMING THE TI

C. Regena

Translating Programs Into TI BASIC

I have had several requests to explain how to translate a BASIC program from another brand of microcomputer to TI BASIC. For example, you may see a program that fits your needs, but it's written for the Apple, or Atari, or TRS 80. How can you rewrite it so that it works on your TI-99/4A?

All the main microcomputers use a programming language called BASIC. However, each brand of computer has its own form of BASIC which may not be compatible with other computers.

To "convert" programs, you first need to be familiar with your TI's language idiosyncrasies: what syntax and spelling to use; where to put spaces, commas, colons, and semicolons; what type of numbers to put in parentheses; and what the limits of parameters are.

The command module for TI Extended BASIC makes conversion easier because Extended BASIC increases programming power by allowing multi-statement lines, PRINT AT or DISPLAY AT features, and more versatile IF-THEN-ELSE logic. This column, however, concerns conversions to the built-in console TI BASIC.

You cannot load a program from cassette or diskette from another brand of microcomputer to your own. In general, the *baud rates* (the rates at which information is transferred from one place to another) are different, and each computer has special character codes which may not be recognized by another computer. Graphics are especially machine-specific.

Games With Graphics And Sound

Action games are probably the most challenging programs to translate because they use graphics and sound. You could run the program on the computer for which it was written (to see what it looks like) and then write your own TI graphics. It's really easier to design your own graphics and

sound than to try to convert line by line. If you see a command in another program with the word SOUND or PLAY, the command is for noises or music; and TI BASIC will require a CALL SOUND statement.

Typical graphics statements in other versions of BASIC contain PRINT with special characters in quotes, or such words as LINE, DRAWTO, HLINE, VLINE, CIRCLE, PAINT, COLOR, SET-COLOR, SET, PSET, RESET, PRESET, INVERSE, GRAPHICS, GR, PMODE, SCREEN, DRAW, or PLOT. Many POKE statements also display graphics or play sounds. Also numbers for graphics commands may be contained in DATA and READ statements.

Common Statements

Many general-purpose programs can be easily converted from a printed listing for another brand of computer. Below are examples of common statements and the translations. The left column contains examples you may see in listings for other computers. The right column gives the TI BASIC equivalent.

Other computers that allow multi-statements often use a colon to separate commands. For the TI simply separate the statements with new line numbers. If there are any branching statements, be especially careful of proper logic and program flow.

100 X = 1:Y = 1:Z = 2	100 X = 1
110 PRINT Y:GOTO 400	102 Y = 1
	104 Z = 2
	110 PRINT Y
	112 GOTO 400

Spaces which are required in TI BASIC may be omitted in other versions of BASIC:

200FORX = 1TO5:PRINTX: NEXTX	200 FOR X = 1 TO 5
	202 PRINT X
	204 NEXT X

A NEXT statement requires the name of the loop variable, and NEXT statements may not be combined.

```
200 FOR D = 1 TO 500:NEXT D
202 NEXT D
300 FOR I = 1 TO 10
310 PRINT I
320 FOR J = 1 TO 100:NEXT J,I
322 NEXT J
324 NEXT I
```

Some computers have special function keys to clear the screen, or they may use the command CLS.

```
100 PRINT (CLEAR)
100 CLS
100 CALL CLEAR
```

CLS with a number following the command clears the screen with a certain color number. TI BASIC can use CALL CLEAR then CALL SCREEN(C) for the color C.

INPUT statements in TI BASIC may have a prompt which is followed by a colon. Other computers may use a semicolon or a comma.

```
200 PRINT "NUMBER?";
210 INPUT N
300 INPUT "ENTER
COST";C
200 INPUT "NUMBER?":N
300 INPUT "ENTER
COST":C
```

TI BASIC allows colons in the PRINT statements to indicate blank lines or to start a new line.

```
200 PRINT:PRINT:PRINT X
300 PRINT "JOHN":PRINT "JACK"
400 FOR L = 1 TO 5
410 PRINT
420 NEXT L
200 PRINT ::X
300 PRINT "JOHN":"JACK"
400 PRINT :::::
```

An IF statement must contain a line number rather than a command after THEN or ELSE. Some computers do not have the ELSE option, but in your translations you may notice it would be appropriate to use an ELSE.

```
200 IF X = 20 THEN X = 1
210 PRINT X
300 IF A = B THEN C = 1:
GOTO 100
310 A = A + 1
400 IF N < 10 THEN N =
N + 1:GOTO 100
410 GOTO 600
500 IF I > J THEN 250
510 GOTO 700
200 IF X <> 20 THEN 210
202 X = 1
210 PRINT X
300 IF A <> B THEN 310
302 C = 1
304 GOTO 100
310 A = A + 1
400 IF N >= 10 THEN 600
402 N = N + 1
404 GOTO 100
500 IF I > J THEN 250 ELSE 700
```

Random numbers may be generated in a variety of ways. The TI BASIC command RND yields a decimal from 0 to 1 (which may then be multiplied by another number). The INT command is used to get random integer numbers (whole numbers). For example, INT(10*RND) yields a random

number from 0 to 9, so INT(10*RND) + 1 or INT(10*RND + 1) will give a random number from 1 to 10. INT(5*RND) + 10 will give a random integer from 10 to 14 - 10, 11, 12, 13, or 14.

TI BASIC also has the command RANDOMIZE to mix up the random selection. Other computers may not have this function or may use the words RANDOM or RAND.

To get a random number from 1 to 6, the following statements are equivalent.

VIC-20	X = INT(6*RND(0)) + 1
TRS-80 CC	X = RND(6)
Apple	X = RND(6) + 1
Atari	X = INT(6*RND(1)) + 1
TI	X = INT(6*RND) + 1

GET and INKEY\$ check to see which key has been pressed on the keyboard for a single key-stroke answer. Some computers may "buffer" several keys. The equivalent TI statement is CALL KEY.

```
200 GET A$:IF A$ = ""
THEN 200
210 IF A$ = "Y" THEN 300
220 IF A$ = "N" THEN END
ELSE 200
200 CALL KEY (0,K,S)
210 IF K = 89 THEN 300
220 IF K <> 78 THEN 200
230 END
```

```
200 A$ = INKEY$:IF A$ = "" THEN 200
210 IF A$ = "Y" THEN 300
220 IF A$ = "N" THEN END
230 GOTO 200
```

How Variables Vary

String variables are handled differently in different computers, so it helps to know what the other computer is doing to be able to convert to the TI. For example, the Atari requires a DIMension statement for the string length. The TI uses a DIMension statement when the string is in an array. The TRS-80 Color Computer may have a statement such as PCLEAR 2000 to clear more memory for strings.

LEN(A\$) returns the length of the string variable A\$. Some computers give the length of the null string, "", as 1, but the TI says the length is zero.

To combine strings in TI BASIC, use the ampersand symbol.

```
200 D$ = A$ + B$ + "XYZ"
200 D$ = A$&B$&"XYZ"
```

LEFT\$, MID\$, and RIGHT\$ are functions that refer to part of the string. The TI BASIC equivalent function is SEG\$.

200 B\$ = LEFT\$(A\$,5)	200 B\$ = SEG\$(A\$,1,5)
(Left five characters of A\$ starting with the first character)	
210 C\$ = MID\$(A\$,7,3)	210 C\$ = SEG\$(A\$,7,3)
(Three characters of A\$ starting with the 7th character)	
220 D\$ = RIGHT\$(A\$,2)	220 D\$ = SEG\$(A\$,LEN(A\$)-1,2)
(Right or last two characters of A\$)	
230 E\$ = RIGHT\$(A\$,R)	230 E\$ = SEG\$(A\$,LEN(A\$)-R+1,R)
(Right R characters of A\$)	

The PRINT AT or PRINT @ statement is another statement you may wish to convert. The PRINT AT statement is followed by one or two numbers which indicate a position on the screen to begin printing. There are two main ways to write this procedure in TI BASIC.

```
200 PRINT TAB(COL);"HELLO".....:
    (where the colons scroll the printing up to the
    proper row.)
```

To print without scrolling:

```
200 M$ = "MESSAGE"
210 FOR I = 1 TO LEN(M$)
220 CALL HCHAR(ROW, COL-1+I, ASC(SEGS
    (M$, I, 1)))
230 NEXT I
```

Lines 210-230 graphically place one letter at a time for the length of the message on the screen.

Several microcomputers distinguish between integers (whole numbers) and floating point numbers (numbers which may contain a decimal). Often the symbol % is used to designate an integer in a variable name (as in B%). This is similar to the way we use \$ to designate a string variable such as S\$. In TI BASIC all numbers are able to contain a decimal (they are floating point numbers). TI BASIC programmers also do not need to worry about single precision and double precision designations.

A function you may see in other listings is FIX. FIX(N) is the same as INT(N) which returns the integer or whole number portion of a number N.

Two symbols you may see in listings are "tokens" or abbreviations: ? (question mark) is the abbreviation for the word PRINT, and ' (apostrophe) is the abbreviation for REM or REMARK.

You may also need to adjust DATA and READ statements because TI BASIC contains the command RESTORE. Other computers might not have it. RESTORE means to start at the beginning of the data list with the next READ statement. You may also RESTORE data beginning with a certain line number. RESTORE 430 indicates that the next READ statement should start with the first data item in line 430.

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TI Structured BASIC

Steven M. Ruhl

There has been a debate for years about the merits of "structured programming." In essence, this approach stresses certain rules and conventions which (according to its supporters) result in better, more easily understood program listings and more efficient programming in general. This discussion of structured programming, as applied to the TI-99/4A, should let you decide this issue for yourself.

Structured programming can help some programmers make fewer errors, and can make complex programs easier to modify. Structured programming involves planning and organization so that a program flows logically from one step to another. Some structured programming enthusiasts even outlaw the use of the GOTO statement, since GOTO interrupts the straightforward flow of a program, and may lead to confusing design.

Structured programming also makes liberal use of REM statements, so someone reading a program listing can understand the program's logic easily.

Structured programmers often employ *modular programming* – breaking a program into a series of problems, and solving each separately. Most programs, for example, can be broken down into four parts: initialization, input, processing, and output. Let's look at each of these parts in turn. The highest-level module in a program is the most general, and it controls the modules below it; as the program progresses, each succeeding module performs more specific tasks.

We can use a simple example to illustrate structured programming. Program 1 asks for seven numbers and prints their sum. Program 2 accomplishes the same task, but it does it according to the rules of structured programming. Let's see how it works.

Initialization

In the initialization module, the variables to be used in the program are defined in REM statements, and are initialized or dimensioned if necessary. The REM statements are indented to distinguish them from normal program statements. The blank REM lines separate program modules.

On some computers, variables must be set to zero at the beginning of a program – SUM=0, for example. The TI-99/4A, however, clears all vari-

ables each time a RUN command is entered, so we needn't worry about that phase of initialization.

If you are using array variables, they may need to be DIMed, and the initialization module is the place to do it. DIM statements, which tell the computer how much space to reserve for your array, can be executed only once for each array variable, and must be executed before any other reference is made to the array.

Since we are adding seven numbers, we dimension a seven-element array in lines 180 and 190. When an array is DIMed, the computer sets the lower limit of the array subscript to zero. In other words, DIM N(7) is really an eight-element array composed of the variables N(0), N(1), N(2), N(3), N(4), N(5), N(6), and N(7).

The OPTION BASE 1 statement in line 180 is a feature of TI BASIC that tells the computer to make the lower limit of the array subscript one rather than zero. So, by using OPTION BASE 1, we eliminate the variable N(0) from our list and end up with a seven-element array.

Note that in Program 1, the variable N was not DIMed. In such cases, the TI automatically sets the upper limit of the array subscript to 10. Program 2 would have worked just as well without lines 180 and 190, but we include them to provide the documentation structured programming requires.

Input

Data can be passed to a program in a number of ways, including the INPUT, READ, DATA, and RESTORE statements. TI Extended BASIC offers a few other input possibilities: ACCEPT, SIZE, ERASE ALL, and VALIDATE.

In our example, a simple FOR/NEXT loop of INPUT statements is used to enter the seven numbers to be added. Structured programmers indent the lines within a FOR/NEXT loop to indicate (visually) what is being accomplished within the loop.

Once the INPUT is completed, control passes to the processing module.

Processing

Here again, a simple FOR/NEXT loop is used to add the values of the seven variables. Program 1 includes the processing statement in its INPUT

loop, a perfectly valid way of handling the problem. The structured program separates the input and processing functions so that the tasks performed by each can be more easily understood.

Output

The output module takes the result of the processing module and, in this case, prints it on the screen. Output also can be sent to printers, tape, or disk.

Since the purpose of most programs is to provide some kind of computed information, or *output*, many programmers begin their program design with a definition of how that output will appear on the screen or the printer. After the form of the output has been determined, the input module can be tailored to produce the kind of information needed.

In TI BASIC, for example, the colon print separator can be helpful in formatting output.

```
PRINT "HELLO": "THERE"
```

will cause the two words to be printed on separate lines:

```
HELLO
THERE
```

Multiple colons can be used to print blank lines between output. For example,

```
PRINT "HELLO": : "THERE"
```

would insert a line of space between the words when they are printed. The same process can be used in TI Extended BASIC, but spaces must be left between the colons, because Extended BASIC interprets a double colon as a multistatement line.

Easy Modifications

One main purpose of following the rules of structured programming is to achieve clarity and understanding. It may take some rewriting to clear up any rough spots and make the documentation complete. A few months from now, you may want to use a modified version of your program to handle another task.

A clearly documented listing can save you the trouble of relying on your memory when you begin making changes. A program written in modules can also allow you to transfer these "sub-programs" to your new program without much modification.

The rules are there for you to follow if you wish. The choice is yours.

Program 1: Demonstration Program

```
100 REM          ADD SEVEN NUMBERS
110 REM
120          FOR I = 1 TO 7
130          PRINT "ENTER NUMBER "; I
```

```
140          INPUT N(I)
150          SUM = SUM + N(I)
160          NEXT I
170          PRINT "SUM OF SEVEN NUMBERS "; SUM
```

Program 2: Structured Demonstration Program

```
100 REM          INITIALIZATION MODULE
110 REM
120 REM          N(1...7) LIST OF SEVEN NUMBERS
130 REM          TO BE INPUT IN LOOP.
140 REM          SUM IS THE SUM OF THE SEVEN
150 REM          NUMBERS N(1)...N(7).
160 REM          INDEX IS USED TO CONTROL LOOPING
170 REM
180          OPTION BASE 1
190          DIM N(7)
200 REM
210 REM          INPUT MODULE
220 REM
230          FOR INDEX = 1 TO 7
240          PRINT "ENTER NUMBER "; INDEX;
250          INPUT N(INDEX)
260          NEXT INDEX
270 REM
280 REM          PROCESSING MODULE
290 REM
300          FOR INDEX = 1 TO 7
310          SUM = SUM+N(INDEX)
320          NEXT INDEX
330 REM
340 REM          OUTPUT MODULE
350 REM
360          PRINT "SUM = "; SUM
370 END
```

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Relocation Calculator

Linton S. Chastain

This automatic analysis of the effects of switching jobs might reveal some hidden economic factors in making career choices. The program will work with either standard or Extended BASIC and either 16 or 32K.

Those of you who have been asked to relocate or may be considering relocating for your own reasons, might be interested in this program called "Salary Comparison." The program, which requires 5055 bytes to run, compares your present salary and cost with the new salary and cost. It gives you the bottom line of either a profit or loss based on the input of the old and new salaries and costs. You have a choice of outputting the old and new salaries and costs with results to the screen or printer.

The input for your old salary and cost should be readily available from your paycheck stubs and household budget. The input for the new salary can be obtained through calculations based on payroll formulas or from interpolations based on percentages of deductions of your old salary, or you may be able to obtain the input needed from the payroll department. The input for the new OUTGO can be obtained from national tax accountants, realtors, and the chamber of commerce in the new location. You can also use an almanac and indexing of the old to the new cost.

The more accurate the inputs, of course, the more accurate the results. (Recall the old computer saw: "Garbage in, garbage out.") Regardless of whether or not you decide to take the new position, at least you have an idea of what it will cost. Your decision may well be a more objective one and, in the long run, a more satisfying one.

```
40 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:AA=0:AB=0:U=0:V=0:Y=0:Z=0:AC=0
:AD=0:AE=0:AF=0:AJ=0:AK=0:AL=0:AM=
0:AN=0:AO=0:AP=0:AQ=0:AR=0:AZ=0:AT
=0:AU=0:AV=0:AW=0:AY=0:W=0:X=0
70 CLS:PRINT"INCOME COMPARISON":PRIN
T:PRINT"COMMAND LIST # 1"
80 PRINT" 1-INPUT SALARY"
90 PRINT" 2-INPUT OUTGO"
100 PRINT" 3-DISPLAY SALARIES"
110 PRINT" 4-DISPLAY OUTGOES"
120 PRINT" 5-DISPLAY DIFFERENCE"
130 INPUT"ENTER COMMAND BY NUMBER";S:
IF S<1 OR S>5 THEN70
140 ON S GOTO150,505,370,760,910
```

```
150 PRINT
160 PRINT:PRINT"ENTER THE FOLLOWING D
ATA AS REQUESTED"
180 PRINT"-SALARY A ;B"
190 PRINT"-FED TAX C ;D"
200 PRINT"-FICA E ;F"
210 PRINT"-STATE TAX G ;H"
220 PRINT"-SAVING BOND I ;J"
230 PRINT"-LIFE INS. K ;L"
240 PRINT"-GP. INS. M ;N"
250 PRINT"-SAVING O ;P"
260 PRINT"-LTD Q ;R"
280 INPUT"SALARY A";A:INPUT"SALARY B"
;B
290 INPUT"FED TAX C";C:INPUT"FED TAX
D";D
300 INPUT"FICA E";E:INPUT"FICA F";F
310 INPUT"STATE TAX G";G:INPUT"STATE
TAX H";H
320 INPUT"SAVING BOND I";I:INPUT"SAVI
NG BOND J";J
330 INPUT"LIFE INS. K";K:INPUT"LIFE I
NS. L";L
340 INPUT"GP. INS. M";M:INPUT"GP. INS
. N";N
350 INPUT"SAVING O";O:INPUT"SAVING P"
;P
360 INPUT"LTD Q";Q:INPUT"LTD R";R
365 GOTO70
370 AA=A-(C+E+G+I+K+M+O+Q):AB=B-(D+F+
H+J+L+N+P+R)
375 INPUT"INPUT PRINT TO CRT(1) OR PR
INT TO PRINTER(2)";S:PX=S
376 IF S<1 OR S>2 GOTO375
377 IF PX=2 THENPP=-2 ELSE PP=0
380 CLS:PRINT#PP,"SALARY COMP. INCOME
1 INCOME 2"
385 PRINT#PP,CHR$(10)
390 PRINT#PP,"SALARY";TAB(13);A;TAB(2
3);B
400 PRINT#PP,"FED TAX";TAB(13);C;TAB(
23);D
410 PRINT#PP,"FICA";TAB(13);E;TAB(23)
;F
420 PRINT#PP,"STATE TAX";TAB(13);G;TA
B(23);H
430 PRINT#PP,"SAV. BOND";TAB(13);I;TA
B(23);J
440 PRINT#PP,"LIFE INS.";TAB(13);K;TA
B(23);L
450 PRINT#PP,"GP. INS.";TAB(13);M;TAB
(23);N
460 PRINT #PP,"SAVING";TAB(13);O;TAB(
23);P
470 PRINT#PP,"LTD";TAB(13);Q;TAB(23);
R
480 PRINT#PP,"-----"
-----"
490 PRINT#PP,"DIF.";TAB(13);AA;TAB(23
);AB
495 PRINT#PP,CHR$(10)
500 INPUT"HIT ENTER TO CONTINUE";R$:I
```

```

FR$=INKEY$ THEN 70
505 PRINT
510 PRINT:PRINT"ENTER THE FOLLOWING D
ATA AS REQUESTED"
530 PRINT"-PROP. TAXES U ;V"
540 PRINT"-CAR & HOME INS. W ;X"
550 PRINT"-FOOD Y ;Z"
560 PRINT"-CLOTHING AC ;AD"
570 PRINT"-MORTGAGE AE ;AF"
580 PRINT"-WATER AG ;AI"
590 PRINT"-N. GAS AJ ;AK"
600 PRINT"-ELECTRICITY AL ;AM"
610 PRINT"-MED. & DENT. AN ;AO"
620 PRINT"-GAS VEHICLES AP ;AQ"
630 PRINT"-EDUCATION AR ;AZ"
650 INPUT"PROP. TAXES U";U:INPUT"PROP
. TAXES V";V
660 INPUT"CAR & HOME INS. W";W:INPUT"
CAR & HOME INS. X";X
670 INPUT"FOOD Y";Y:INPUT"FOOD Z";Z
680 INPUT"CLOTHING AC";AC:INPUT"CLOTH
ING AD";AD
690 INPUT"MORTGAGE AE";AE:INPUT"MORTG
AGE AF";AF
700 INPUT"WATER AG";AG:INPUT"WATER AI
";AI
710 INPUT"N. GAS AJ";AJ:INPUT"N. GAS
AK";AK
720 INPUT"ELECTRICITY AL";AL:INPUT"EL
ECTRICITY AM";AM
730 INPUT"MED. & DENT. AN";AN:INPUT"M
ED. & DENT. AO";AO
740 INPUT"GAS VEHICLES AP";AP:INPUT"G
AS VEHICLES AQ";AQ
750 INPUT"EDUCATION AR";AR:INPUT"EDUC
ATION AZ";AZ
755 GOTO70
760 AT=U+W+Y+AC+AE+AG+AJ+AL+AN+AP+AR:
AU=V+X+Z+AD+AF+AI+AK+AM+AO+AQ+AZ
770 CLS:PRINT#PP,"SALARY COMP.  OUTGO
1(3 SPACES)OUTGO 2"
780 PRINT#PP,CHR$(10):PRINT#PP,"PROP.
TAXES";TAB(13);U:TAB(23);V
790 PRINT#PP,"C & H INS.";TAB(13);W;T
AB(23);X
800 PRINT#PP,"FOOD";TAB(13);Y;TAB(23);Z
810 PRINT#PP,"CLOTHING";TAB(13);AC;TA
B(23);AD
820 PRINT#PP,"MORTGAGE";TAB(13);AE;TA
B(23);AF
830 PRINT#PP,"WATER";TAB(13);AG;TAB(2
3);AI
840 PRINT#PP,"N. GAS";TAB(13);AJ;TAB(
23);AK
850 PRINT#PP,"ELECT.";TAB(13);AL;TAB(
23);AM
860 PRINT#PP,"MED.&DENT.";TAB(13);AN;
TAB(23);AO
870 PRINT#PP,"GAS VEH.";TAB(13);AP;TA
B(23);AQ
880 PRINT#PP,"EDUC.";TAB(13);AR;TAB(2
3);AZ
885 PRINT#PP,"-----
-----"
890 PRINT#PP,"TOTALS";TAB(13);AT;TAB(
23);AU
900 INPUT"HIT ENTER TO CONTINUE";R$:I
FR$=INKEY$ THEN 70
910 CLS:PRINT#PP,CHR$(10):PRINT#PP,"S
ALARY COMP.  INCOME 1  INCOME 2"
920 PRINT#PP,CHR$(10):PRINT#PP,"NET I
NCOME";TAB(13);AA;TAB(23);AB
930 PRINT#PP,"OUTGO";TAB(13);AT;TAB(2
3);AU

```

```

940 PRINT#PP,"-----"
-----"
950 AV=AA-AT:AW=AB-AU
960 PRINT#PP,"NET MONEY";TAB(13);AV;T
AB(23);AW
970 AY=AW-AV
980 IF AW>AV THEN PRINT#PP,CHR$(10):
PRINT#PP,"A PROFIT OF ";AY;"DOLLARS"
990 IF AW<AV THEN PRINT#PP,CHR$(10):P
RINT#PP,"A LOSS OF ";AY;"DOLLARS"
1010 INPUT"HIT ENTER TO CONTINUE";R$
1020 IFR$=INKEY$ THEN70

```



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Modifications Or Corrections To Previous Articles

VIDEO 80 For Atari

Brad Brooks points out that the 80-column software from the April issue (p. 170) can be restarted after a SYSTEM RESET without having to power up again. Simply type ?USR(9013). You'll get an ERROR 9 message, but this does not affect program operation.

Match-Em

This game for the TI in the April 1983 issue (p. 123) has a minor flaw. Hitting the same key twice will register as a valid match. Our thanks to reader James Alessio, for suggesting the following fix:

```
1085 IF A2=A1 THEN 1030
```

TI Air Defense

The confusing characters at the beginning of line 1950 of the TI version of this game (page 46 of the April issue) should be replaced with the command PRINT.

Atari CRAB

This Atari BASIC cross-reference program from the April issue (p. 188) has problems when handling inverse video characters or USR codes in quotes. To prevent this, reader David Butler suggests adding the following line:

```
245 IF C=15 THEN GOSUB GC FOR J=I TO C:GET #I,G: NEXT J:GOSUB GC
```

Also, some printers add a carriage return after LPRINT;. To correct this, David offers the following modifications:

```
390 OPEN #I,8,Z,"P:":PRINT #I;"XREF FOR "  
;A$  
420 D=INT(LN/H):M=LN-H*D:IF NOT M THEN PRINT #I:PRINT #I  
430 PL=PEEK(X+T):FOR J=5 TO PL-T:PRINT #I  
;CHR$(PEEK(X+J));:NEXT J  
440 PRINT #I;" ";:IF NOT M THEN PRINT #I  
460 PRINT #I:PRINT #I:PRINT #I:D-L+I;" VARIABLES"
```

Apple Subroutine Capture

In the text for the EXEC file (Program 1, page 171) of this article from the March issue, be sure that the word "RUN" appears (without a line number) as the last line in the file or the program will not operate properly.

VIC Data Acquisition

In the program on page 248 of the May 1983 issue, the POKE 37166,128 in line 20 should be replaced with POKE 37166,64.

ZX-81/TS-1000 Data Management

Line 2065 of this program from the March 1983 issue (p. 230) should read:

```
2065 IF N$(S,1 TO 30)=S$(1,1 TO 30) THEN  
GOTO 2140
```

Color Computer Version Of Vehicle Cost Performance

In line 770 (February 1983, p. 164), the WRITE#1 should be PRINT#1. In line 1160 the CLD should be CLS. In line 1250, the "GALLONS";Y should be "GALLONS",Y.

Commodore Maze Generator Enhancement

The maze generating program by Charles Bond reprinted in the February issue (p. 106) has a shortcoming. The fixed order of the elements in the A(3) coordinate array generates mazes that almost invariably spiral counterclockwise around the screen. Neil Murray suggests stirring in a little randomness by adding the following line:

```
115 FOR I=3 TO 1 STEP -1:K=INT(RND(I)*I):  
SV=A(K):A(K)=A(I):A(I)=SV:NEXT I
```

Automatic Commodore Program Selector

The programs which accompany this article from the March 1983 issue (p. 156) require modification to work with the VIC-20 and 1540/1541 disk drive. All output to the screen should be adjusted for the 22-column display. Line 290 of Program 1 and line 470 of Program 2 should be changed to:

```
PRINT "{4 DOWN}RUN":PRINT"RUN":PRINT"  
{HOME}{7 DOWN}";
```

In Program 3, delete line 420 and make the following changes:

```
210 DIM AES(150)  
240 PRINT:PRINT:PRINT"READING{2 SPACES}D  
RIVE 0"  
250 PRINT"{DOWN}PROGRAMS FOUND: 0"  
290 IF C$=CHR$(220) THEN 410  
350 PRINT"{UP}"TAB(17)AN-A0  
440 MM=9:PRINT"{CLR}{RVS}PROGRAM MENU #"  
STR$(MN+1)"{OFF}{DOWN}"  
460 PRINT TAB(3)"{RVS}"RIGHT$(STR$(I),1)  
"{OFF}"MID$(AES(MN*9+I),3,16)"  
{DOWN}"  
470 NEXT:PRINT"{RVS}MAKE A CHOICE OR  
{OFF}"  
480 PRINT"{RVS}PRESS 'RETURN' {OFF}"  
590 PRINT"RUN":PRINT"RUN":PRINT"{HOME}  
{7 DOWN}";
```

For the Commodore 64 with 1541 drive, delete line 420 and make the following changes to Program 3:

```
210 DIM AES(150)  
290 IF C$=CHR$(199)THEN 410
```

computers.

KOPAK Creations has introduced the \$99.95 KOPAK Keyboard. Its features include: Sinclair/Timex markings on keys, five single-stroke keys, shift lock, a full-size space bar, additional ENTER and extra shift keys, sculptured keys, an optional numeric keypad, and an optional aluminum case.

KOPAK Creations, Inc.
448 West 55th Street
New York, NY 10019
(212)757-8698

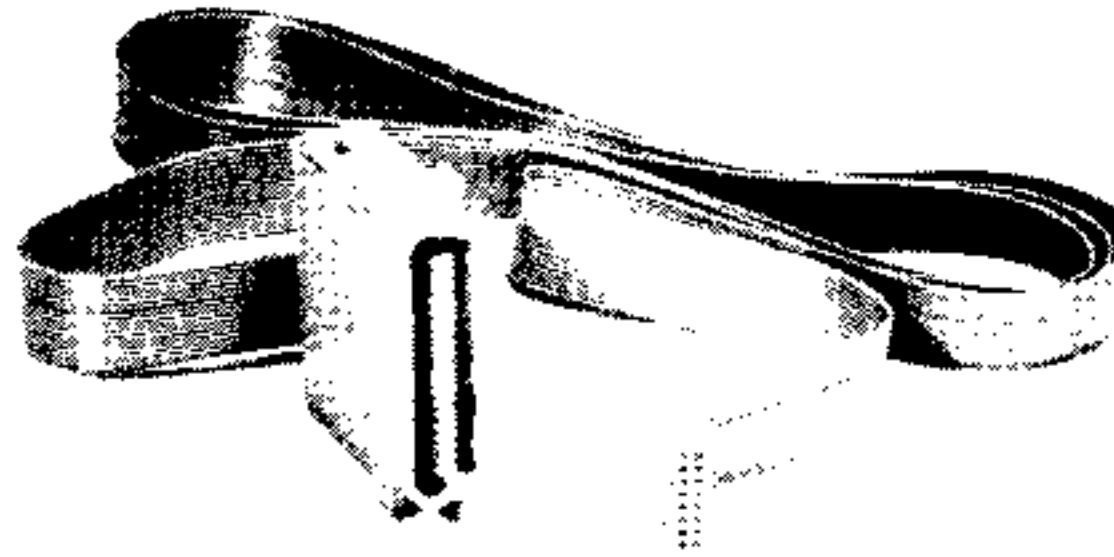
The E-Z Key 60 keyboard is described as a "tactile feel" keyboard that plugs into the same connectors as the existing keyboard. It includes 60 keys, molded legends on key tops, keys for edit, delete, single and double quotes, colon, semicolon function, and stop, two shift keys, a numeric keypad, and an optional mounting base.

The E-Z Key 60 sells for \$84.95.

E-Z Key
Suite 75A
711 Southern Artery
Quincy, MA 02169
(617)773-1187

Parallel Interface Cables For TI

TENEX Computer Marketing Systems has developed an interface cable making the Texas Instruments 99/4A computer compatible with several Centronics standard printers such as the Okidata and Smith-Corona TP-1. The parallel output from the TI's



TI/CEN parallel interface cable for the TI-99/4A.

RS232 Interface is modified within the connector housing of the new TI/CEN cable. The cable is priced at \$37.95.

TENEX Computer Marketing Systems
Box 6578
South Bend, IN 46660
(219)277-7726

Color Author For TRS-80

Radio Shack is introducing a courseware development system for the TRS-80 Color Computer 32K disk system.

Color Author allows educators with no previous experience to create instructional materials for delivery on the computer. The menu-driven system guides the user through the lesson-creating process. Lessons may contain tutorial text, questions, and graphics. The instructor creates lesson frames



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New Epson FX-80 Printer

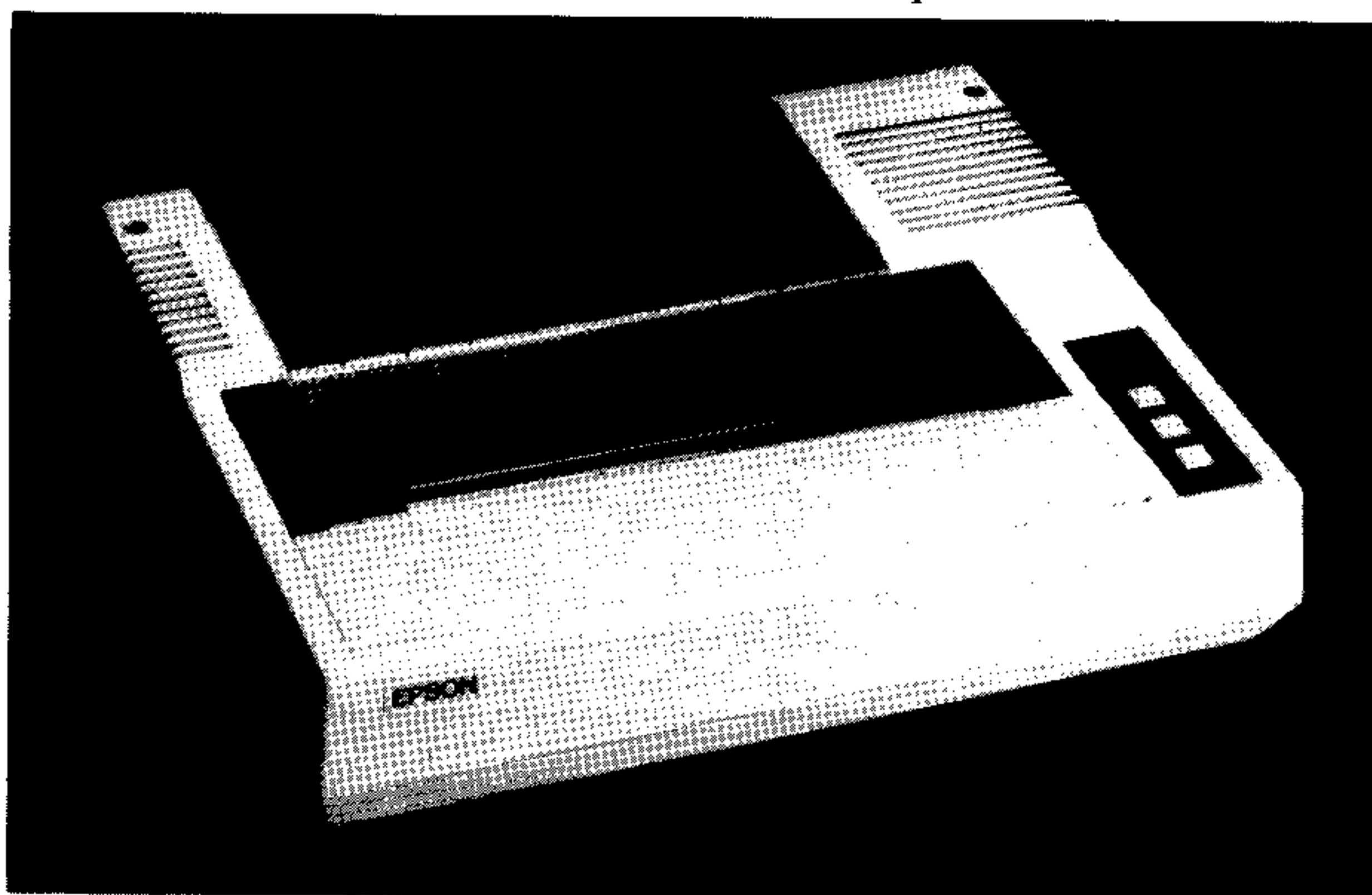
The FX-80, a high-performance bi-directional printer with a printing speed of 160 characters per second, is now available from Epson America.

The FX-80 offers a software-selectable choice of elite (12 cpi) or pica (10 cpi) print spacing. In addition, users can send their own special fonts from their

spacing, pin- and friction-feeds, and a standard parallel communications interface, with serial or IEEE 488 interfaces also available as options.

Four different printing densities – normal, emphasized, bold, and double-emphasized – are available.

The short-form tear-off bar will aid in the production of computer-generated paychecks and other pre-printed forms. The tear-off bar separates the paper from the printer one-inch from



Epson's dot-matrix printer.

computer system to the printer, downloading the font into the printer's memory. This feature will be of particular help to those using math, engineering, foreign language, or medical applications.

The FX-80 also features a one-to-one graphics ratio – the dot-matrix has the same scale vertically as horizontally; accurate graphics, including true circles, can be drawn with the dot-addressable graphics capability. Also incorporated into the new printer is a 2K-byte buffer, which allows buffered printing on longer productions.

The new Epson printer provides 9x9 dot-matrix characters with full descenders and is downward compatible with the Epson MX Series of printers. Also featured is proportional

the last printed line.

The Epson FX-80 printer retails for \$699.

Epson America, Inc.
3415 Kashiwa Street
Torrance, CA 90505
(213)539-9140

Statistical Graphs For The Timex/Sinclair

Practical Computer Products has announced the release of their statistical aid, *Graphpak*, for the Timex/Sinclair 1000. The program presents numerical information in a visual format: bar graphs, line graphs, pie charts, and area graphs (rectangles divided to show percentages).

Graphpak plots scientific data and assists in business and family financial planning. It is a 10K BASIC program which is listable. Available on cassette for \$14.95. Shipping and handling is included, but California residents should include 6% sales tax. Send an SASE for details.

Practical Computer Products
21111 Strathmoor Lane
Huntington Beach, CA 92646

EPROM Programmer For Atari

Creative Firmware of Dallas, Texas, recently introduced a low-cost EPROM development system for Atari computers. This system includes the following items:

1. The Memory-Maker EPROM Programmer comes in kit form and permits programming of 2716 and 2532 EPROMs. The machine language software is available for either cassette- or disk-based systems and includes EPROM blank checking, programming, and verifying. Also included are the capabilities to read most 2K and 4K ROMs, edit any loaded software, list this software to the screen or printer, examine any portion of computer memory, and save any portion of computer memory to disk or tape. The save and load functions are compatible with DOS binary files. Assembly time for this kit is approximately one hour. The kit includes all parts, including power supply and zero-insertion force socket. The case is optional.

2. For those desiring to program 2732 or 2732A EPROMs, the Creative Firmware 2732/2732A Programming Adapter kit. This unit drops into the zero-insertion force socket on the Memory-Maker and permits switch selection of 2732 or 2732A EPROMs. It contains its own zero-insertion