

ARIZONA 99 UG
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TI HOME COMPUTER NEWSLETTER FEB.-MARCH 1984 \$1.95

ARIZONA 99 UG

As Texas Instruments withdraws from the Home Computer market, one of the prime concerns is that you, 99/4A owners, remain informed and can get assistance when needed. The ARIZONA 99 UG is actually increasing it's efforts in this direction, in order to insure that you will get the most from your computer in the future.

The 99/4A is still one of the finest computers for the money. TI didn't fail due to a poor computer. Their problem was poor marketing.

NEWS RELEASE

TI has released details concerning steps the company is taking to provide owners of 99/4A Home Computers with continued support for their computers.

WARRANTY AND REPAIR

TI will stand behind its limited warranty on the company's hardware and software as stated in the owner's manual - one year for computer consoles and 90 days for all other hardware and all software. In addition, TI will maintain service capability for out-of-warranty repair.

TI CARES HELPLINE

TI will continue to provide the toll-free helpline, 1-800-TI-CARES, on a six-day-a-week basis. Because of the heavy activity currently on these lines, some delay may be experienced. In addition to providing information concerning operation and repair, Texas Instruments will also take orders while inventories last for sales of peripherals and software that 99/4A owners cannot locate through local retail outlets.

CONTINUED COMMUNICATION

TI is taking several steps to provide

up-to-date information to all known owners of 99/4A Home Computers. All owners who have received copies of newsletters or direct mail pieces from Texas Instruments will continue to receive information. Also, all new owners who send in their Owner Information Cards will be added to this mailing list. Any owner who wishes to have his name added to this list can do so by either sending in his Owner Information Card or by sending his name, address, and 99/4A serial number to:

TEXAS INSTRUMENTS

P.O. BOX 53

LUBBOCK, TX 79408

Communications currently planned include newsletters, catalogs, and direct mail pieces.

The TI-99/4A Newsletter from Texas Instruments will continue to be published for two more issues, currently planned for January and April, 1984.

Arrangements have been made for a quarterly catalog of Texas Instruments peripherals and software for as long as TI's inventories allow.

THIRD-PARTY SOFTWARE AND PERIPHERALS

TI is encouraging third-party manufactures of software and peripherals to produce products compatible with the 99/4A Home Computer.

TI will issue licenses for its auto-incrementing memory feature incorporated in its GROM chip and will sell GROMs to interested third-party software manufacturers through TI's Semiconductor Group. In addition, TI is negotiating with third parties interested in manufacturing 99/4A software originally authored by Texas Instruments. TI plans to continue to produce software until TI piece-part inventories are depleted.

Further information about actions taken by Texas Instruments to provide support to the owners of the 99/4A will be communicated through this newsletter.

NEWS RELEASE

TI, Walt Disney, and Sierra On-Line announced they have reached agreement in principle for Sierra On-Line to assume the responsibility of manufacturing and marketing five TI-99/4A educational software programs. These five programs, which feature a number of Walt Disney characters, were developed by Disney for TI under an earlier manufacturing and marketing agreement. Under the new agreement, Sierra On-Line will take over the manufacturing and marketing originally to be performed by TI. As in the earlier agreement, Disney will distribute these programs to the school market.

This agreement provides for the use of Disney characters in educational software programs originally conceived by Disney for Texas Instruments and the 99/4A. Among the characters used in th programs are Peter Pan, Pinocchio, Winnie the Pooh, and Professor Ludwig Von Drake.

"This agreement is part of our plan to provide alternative sources of quality software for owners of TI-99/4A Home Computers," said Dale Osborn, Manager in charge of phaseout of TI's Home Computer operations. TI announced in October that it was withdrawing from the consumer home computer business, but said that it planned to take steps to provide continued support for the 99/4A.

"Walt Disney is pleased that these exciting educational programs will be available from Sierra On-Line for the 99/4A Home Computer and other computers," said Rich Boehning, Vice President of Institutional Media for Disney.

"We look forward to serving the large number of 99/4A Home Computer owners with this new software, and we hope to continue providing this and other software for the 99/A," said Ken Williams, President of Sierra On-Line.

Texas Instruments continues to discuss with third parties the manufacture and marketing of additional software for the 99/4A.

TI AND IMAGIC REACH AGREEMENT

TI and Imagic announced that Imagic will assume the marketing

responsibilities for five Imagic software programs for the 99/4A for which Texas Instruments had obtained manufacturing and marketing rights.

"we are pleased that Imagic has agreed to market these five Imagic software games previously announced by TI for the 99/4A," said Dale Osborn, Manager in charge of phaseout of TI's Home Computer operations. "This agreement is yet another step by TI to provide TI-99/4A Home Computer owners with additional sources of software for their computers."

The game software to be available for the TI-99/4A under the agreement includes Imagic's Demon Attack, Microsurgeon, Fathom, Wing War, and Moonsweeper. Imagic already markets these games for other computer systems.

GROM WARNING

As you may already know, TI shipped a number (in the tens of thousands) of beige consoles that will NOT run a pure ROM cartridge (there must be at least 1 GROM chip). The Atari cartridges will NOT run on some of these consoles.

Luckily, it is very simple to tell which beige consoles have the auto incrementing GROM. Simply turn on the computer and look at the MASTER SCREEN. If it says copywrite 1981 it is OK. If it says copywrite 1983 V 2.2 you won't be able to run most of the third party solid state cartridges that are currently on the market.

TI's intention for converting the latest beige consoles to auto incrementing GROM operating systems was an attempt to protect their own solid state cartridges.

Since TI has always used a GROM chip, all of their cartridges will work on any of the beige consoles.

If you're buying a beige console and it's important to you that it run these cartridges, test it out before buying it.

PROGRAMMING TIP

To change the screen color for the programming mode: TYPE 10 REM and hold down the CTRL U until the cursor has covered about three lines. Then TYPE 10 and press FCTN X. Now press the space bar once or twice. Next you press the FCTN and 4 keys. This trick is for

EXTENDED BASIC. Now you will be able to program with a different screen color than cyan. In BASIC, this trick will change the border color only.

THE SECRET ASSEMBLER

by J.R.KLABUNDE

When someone mentions assembly language programming, many computer users, even experienced BASIC programmers, have a feeling that this is somehow just too difficult or complicated for them to understand. While assembly is indeed more difficult to learn, it is certainly not out of the reach of understanding for anyone willing to devote a little extra time and effort. If you can program in Basic, YOU CAN LEARN ASSEMBLY LANGUAGE!

The rewards for learning assembly language are many. While not everyone will write a fancy game or a business program, a reasonable effort can produce small utility programs to enhance Basic. One of the biggest advantages of assembly is in speed. It can be over 100 times faster than Basic! Also, you have access to all the capabilities of your TI99/4A, many of which are not available in any other way.

As an owner of a TI99/4A, you have the most advanced home computer ever manufactured. The built-in functions, capabilities, and accuracy are unmatched by any other small computer yet offered by any company. The ease of use is also unequalled. The 16 bit TMS9900 microprocessor IC in your unit uses 9900 assembly language. It is one of the highest level assembly languages available on a 16 bit processor. In fact, your little TI99/4A uses the same assembly language as the TI990 Business Minicomputers! Where 9900 assembly really excels over many other assembly languages is that it is also one of the easiest to learn. This is what can make the most difference to the beginner.

In order to write and run 9900 assembly language programs, you need either a Mini-Memory Module and Cassette Recorder; or the Editor Assembler Module, 32K Memory Expansion and a Disk Drive. You can also run properly written assembly code using the Extended Basic Module and 32K Memory Expansion. A useful reference is the Editor Assembler Manual included with the

Editor Assembler Module and also available separately from many TI distributors. Get yours while they are still available!

Just what does an assembly language program consist of? Like Basic, it is a set of instructions that tell the computer to take certain actions dependent on certain conditions which you define in a series of program statements. The difference is that the programmer is responsible for many more details with assembly than with Basic. Computers are really stupid machines at this level. You must do all the thinking and planning to make the program work. Some of the details you must supply are such things as memory addresses of data, or destinations for results of computation. The advantage to this extra responsibility is that you can now control the actions of the computer down to the smallest detail, and all at the top speed the system is capable of. (This is part one of a series of articles that will help you with assembly language.-Ed.)



JOYSTICKS

Have you ever had difficulty finding which joystick is to be used in a program? If the program is written for joystick #1 then #2 won't work. Or if the program is written for joystick #2 then #1 won't work.

You can use this little trick in your programs to solve the problem. With this program all you do is push the Fire Button on either joystick and the computer will then remember which joystick you are using.

```
100 CALL KEY(1,J1,STATUS)
110 CALL KEY(2,J2,STATUS)
120 IF J1+J2 <>17 THEN 100
130 JS=INT(J1/18+J2/9+1)
```

With this little program prior to the use of CALL JOYST(JS,J,STATUS) in your own program, the computer will respond to whichever joystick you were using when you pressed the fire button!

TI VS. APPLE

At the COMDEX show in Las Vegas, Apple was demonstrating a new board called the Arcade Board. It plugs into the Apple. It had very good graphics and sells for \$400.00. It was called the supreme board for the Apple. The Apple Card uses the TMS9918A UDP chip that your TI-99/4A uses. This allows the Apple to do SPRITES just like your computer. However, just the board sells for more than most of us paid for the whole 99/4A computer.

DISK DRIVE TIPS

TIP #1

If you plan to save a program you are typing into the computer, you must turn on the disk drive first, then the computer, and then type in the program. If by accident you type in a program with out the disk drive being turned on first, DON'T try to turn it on after typing and try to save your program. The computer will lock up and you will have to turn off the computer. Of course your program will be lost then. If this ever happens to you, first save the program to cassette tape, then turn off the expansion system and the computer. Now turn on the expansion system first, then the computer, and read the program back from cassette tape. Finally, you can save the program to disk with no problem.

TIP #2 Some of you have been having trouble reading long programs from cassette tape into the computer with the disk drive on. You will keep getting ERROR FOUND IN DATA on the screen. This happens because the program is conflicting with the RAM memory that is being used by the disk drive.

Not to worry! This tip will save your day. Type in the following from the immediate mode: NEW then CALL FILES(1) and finally NEW again. This will free up about 1500 bytes of RAM memory and in most cases will allow the program to enter the computer memory from cassette tape.

ADVENTURE CASSETTES TO DISK

Like most computer users, you probably started out with a cassette recorder to read programs from. Now many of you have upgraded to disk and have ADVENTURE GAMES (Adventureland, Mystery Fun House, Ghost Town and many more) on cassette tape. Most users would like to transfer their ADVENTURE series from cassette to disk. The ADVENTURE COMMAND MODULE, however, is one of a few modules that will not allow you to transfer from cassette to disk. Many have tried and been unsuccessful.

If you have the TUNNELS OF DOOM command module, the knowledge that follows will bring you success. You will be able to copy from cassette to disk with a few relatively minor characters being defined incorrectly.

Insert the TUNNELS OF DOOM module and load the ADVENTURE game you want to convert from cassette. After it is loaded into the computer press FCTN 9. The screen will display a load/save menu. Select the appropriate number (5 or 6) and enter the filename you wish to save it as.

You will now have a workable copy on disk.

INSIDE THE 99/4A

To really understand and appreciate this article, you should have either the MINI MEMORY or the EDITOR/ASSEMBLER. If you don't, you will still get some valuable information that will help you understand what the computer is doing when you program in BASIC, or EXTENDED BASIC.

ROM AND GROM

Inside your 99/4A computer are 26,000 bytes on ROM and GROM solid state memory. The console ROM contains the start-up code that initializes the 99/4A's operating system. It includes the GPL (Graphics Programming Language) interpreter. This interpreter does all the hard work of converting your BASIC, or EXTENDED BASIC into a form that the computer can understand and run.

GPL uses the GROM memory (Graphics Read Only Memory) to fetch instructions and execute. The GROM is a proprietary solid state chip manufactured by Texas Instruments, and it is programmed to be self-incrementing. Unlike standard ROM chips. By auto-incrementing, the GROM

can be used for reasonably fast access time of sequentially organized data (such as loading a character set into memory) at a low cost of manufacture.

The GPL interpreter is not all the Console ROM contains. The ROM has stored in it's memory all the necessary routines to interface the 99/4A to other peripherals. When you turn on the computer, one of the first things it does is cycle thru all the peripherals that are attached to it and perform an initialization process so that it will know how to talk with the peripherals when called to do so. Now you understand why all peripherals must be turned on before the computer is turned on.

The ROM memory also contains floating-point routines (for math) and all the mathematical functions (TAN,COS,SIN,etc.) for BASIC, and EXTENDED BASIC.

The next issue of this newsletter will have valuable information about how the LOADER, the DSR, the PAB, the DSRLNK, and the GPLLNK operate.

SHARPER PICTURE

As you know, the screen color while running a built-in BASIC program is green (blue in EXTENDED BASIC). If you have a color TV this is fine. But if you only have black-and-white, then try this trick for a sharper picture. Add the following statement to the beginning of your program:

```
10 CALL SCREEN(15)
```

This will disable the color-generating circuit in the 99/4A and removes the pattern of vertical lines often seen on black-and-white TV. It also increases the sharpness of the characters.

QUESTIONS

Q. If I use a variable name many times in a program, should a constant be assigned?

A. Yes, you will get two advantages: 1) Space efficiency; and 2) time efficiency.

A single-letter variable name requires one byte in a program. A constant requires two bytes plus one byte for each digit. But the constant can be used many times without using more memory.

Q. I have heard a smaller program will execute faster. Is this true?

A. If the program was made smaller by replacing numeric variables with string variables, the program will actually run slower. Even though it is smaller (taking less memory). However, reducing the number of different variables in a program will speed it up. The computer will average less time to find a variable and its value when needed. Also, reducing the number of lines in a program will speed it up, since the computer averages less time to find a line in a GOTO or GOSUB.

EXTENDED BASIC SECRET

This tip will be of great help to you EXTENDED BASIC programmers with the 32K RAM CARD and DISK DRIVE. The following program looks into a memory location and finds out if a SPEECH SYNTHESIZER is attached. With out this knowledge, your program must ask the user if a SYNTHESIZER is attached, or the program will crash and destroy the memory contents.

```
5 CALL CLEAR
10 CALL PEEK(-28672,SPEECH)
20 IF SPEECH=0 THEN 100 :: IF
SPEECH=127 THEN 30
30 PRINT "YES SPEECH"
40 CALL SAY("HELLO")
50 STOP
100 PRINT "NO SPEECH"
```

ADVANCED PROGRAM TIP

You must have the MINI MEMORY or the EDITOR/ASSEMBLER to use this programming tip. The program uses some memory addresses that most programmers have not yet discovered.

Using the MINI MEMORY or the EDITOR/ASSEMBLER type in the following program from TI BASIC (not assembly). You will find that pressing the following keys will unveil some secrets: 'N' for NORMAL MODE, 'C' to CLEAR THE SCREEN, 'T' for TEXT MODE, 'M' for MULTICOLOR MODE (each character is a 4X4 block), and 'B' for BIT MAP MODE (99/4A only).

For you advanced programmers, you now know the secret of getting 40 columns on the screen (not the normal 32). You will also eventually figure out how to address every pixel on the screen. As you can see, contrary to most

```

literature, it can be done from basic.
 90 PRINT "PRESS:":'"N' FOR NORMAL
MODE":'"C' TO CLEAR SCREEN":'"T' FOR
TEXT MODE ":'"M' FOR MULTICOLOR MODE"
100 PRINT "'B' FOR BIT MAP MODE"
110 CALL KEY(3,G,S)
120 IF G<>78 THEN 140
130 CALL POKEV(-32768,0)
140 IF G<>67 THEN 160
150 CALL POKEV(-32352,0)
160 IF G<>84 THEN 180
170 CALL POKEV(-32272,0,"",-30945,0)
180 IF G<>77 THEN 200
190 CALL POKEV(-32280,0)
200 IF G<>66 THEN 220
210 CALL POKEV(-32766,0)
220 GOTO 90

```



BEGINNING GUIDE TO CASSETTE

Knowing how to use your computer to read cassette programs will allow you to use many programs that are not available in COMMAND MODULES and it will also lower your program cost. Cassette programs can save you many dollars. You can begin by typing in the programs that are in this newsletter or ordering them and reading them into you computer.

The items you will need to get started are a tape recorder cable, a cassette tape recorder, and some cassette tapes. The Dual Cassette Cable PHA2000 will allow your computer to talk with two cassette recorders and it is available locally from all the retailers that sell the TI-99/4A.

It is important that you get a good tape recorder because it will save you many hours in the future in reading your cassette tapes.

A computer can really only understand two things. A signal that is "on" or a

signal that is "off". All the information that is stored or read from the cassette recorder tape is converted to an "on" or an "off".

Your computer will have to be able to read in bytes of data ("ons" and "offs") from a tape recorder. This is done by using two tones, each with a different frequency. The lower frequency means "off" to the computer and the higher frequency tone means "on". If you have a tape recorder that has trouble recording or playing back the higher frequency, your computer would be able to hear only "offs". Therefore, to read data from a cassette recorder, you must set the tone to be both loud enough and set the tone to help make the frequency right.

Some tape recorders have a hard time producing and reproducing the high frequency tones properly, so TI programmed your computer to be sure that it has read all the data. The 99/4A counts the number of "ons" that it heard and after a few bytes of data, it expects to read a number on the tape that tells it how many "ons" it should have read. If the two numbers don't match, it knows a "parity error" has occurred and the computer will print on the screen to tell you that it has had a problem.

If the volume is set up too high then distortion occurs and the tones will not be heard accurately by the computer. If the volume is too low, the computer will not hear the tones (even though you can probably hear them on the tape).

A good tape recorder must be able to handle both the high and low frequency tones and also be capable of reproducing them within a small range of frequency error. In order to playback the higher frequency tone, it is usually necessary to have the tone control set at, or near, maximum.

Also, the recorder needs to be capable of small volume adjustments so the tones are loud enough to be heard by the computer but low enough so that distortion does not occur.

The recorder must also be fast enough to record and playback the very quick frequency shifts.

CASSETTE POLARITY?

Some of the tape recorders on the

market are very good at supplying the needed criteria in frequency response and all of the above criteria to be very reliable with the 99/4A. However, there is one additional problem that you may have with a tape recorder. The computer turns the recorder on and off by the remote control jack (the black wire on the cassette cable). This remote jack is really designed to work with the manufacturer's recommended microphone, and there is no guarantee that the jack is hooked up the way that the computer needs it to be. You have about a 50-50 chance when you just go out and buy a cassette recorder. Therefore, your recorder may not be capable of being turned on and off automatically by the computer. Luckily, the ARIZONA 99 USERS' GROUP makes a CASSETTE CONTROL (\$4.95) that can be used between your recorder and the TI cable if your recorder is the wrong polarity. If you don't want to spend the money for this CASSETTE CONTROL, you can get by without it, by starting and stopping the recorder manually. This will work fine unless you intend to use cassette files. If so, you will need the recorder under automatic control of the 99/4A.

----- MEMORY IN THE 99/4A

To help understand memory, you must first understand some basic terms and how they apply to the 99/4A.

The Central Processing Unit (CPU) in your computer contains circuitry for arithmetic functions, hardware register, comparisons, and functions that process computer instructions.

Memory is divided into RAM (Random Access Memory) and ROM (Read Only Memory). Ram can be written to, and read from, by your program. ROM can only be read and is not altered by your program. ROM stores the information for the built-in TI-BASIC and the alphanumeric characters.

Each byte in the computer's memory is assigned a number called the address. They are usually referred to in hexadecimal notation and are mapped as follows:

Addresses >0000 through >1FFF are built into the 99/4A and contain 8K bytes of ROM for TI-BASIC.

Addresses >2000 through >3FFF are the 8K bytes of RAM that make up the low

memory in the MEMORY EXPANSION CARD if you have it.

Addresses >4000 through >5FFF are included in various peripherals. They have up to 8K bytes of ROM for the Device Service Routine used to run peripheral devices. This is how TI added state of the art peripherals to your 99/4A. The 99/4A doesn't need to know in advance what peripherals will be added in the future because of this capability. VERY GOOD IDEA TI !!! Now third-party hardware developers will be able to provide us with equipment in the near future.

Addresses >6000 through >7FFF are the Command Module port. This port can address ROM and RAM.

Address >8000 through >9FFF are included in the console. They contain CPU RAM and all of the memory-mapped device locations.

Address >A000 through >FFFF are the 24K bytes of RAM that is the high memory of the MEMORY EXPANSION CARD.

----- TERMINAL EMULATOR TIP

If you have the Speech Synthesizer and the Terminal Emulator II cartridge, you can have your computer speak each line of your program. This is helpful when you're trying to find a typing error in a program you have typed from a magazine or an article.

With your program in memory and from BASIC type in: LIST "SPEECH". You can also list any part of a program by entering a colon immediately after the LIST "SPEECH" command. You must follow the colon with : a single line number; a single line number preceded by a hyphen; a single line number followed by a hyphen; or a hyphenated range of line numbers.

----- EXTENDED BASIC PRESCAN

Have you ever wondered why it takes so long for a program to run after you type in RUN? The pause is the time the computer takes to pre-scan your program to set up memory space for variables, arrays, data, and subprograms. The computer has to go over each line and reserve memory space. This takes a lot of time because it must proceed through each instruction, perform the appropriate functions, and establish variable values. The time required to

pre-scan depends on the length of the program. There is a way to reduce this wait time using EXTENDED BASIC. This is just one of many reasons we recommend EXTENDED BASIC as the best first purchase you can make after buying the 99/4A.

Unlike most of our tips, this one is documented in the EXTENDED BASIC manual, but few seem to take advantage of it. (Our FROGGY program does -Ed.)

The commands are **pre-scan off** and **pre-scan on**. These commands allow you to control which instructions will not be pre-scanned. In a program, only those instructions which contain the first reference to the variables need to be pre-scanned. Therefore, you will find that many program lines don't require a pre-scan.

A 23K byte program that would normally take 31.5 seconds to start RUNNING will only take 9.5 seconds by using the pre-scan commands. As an added hint, think about the time you could save by having the program reset itself by RUNNING itself and using the pre-scan commands. Execution speed is greatly increased. (The ARIZONA 99 UG FROGGY game uses this trick -ED.)

***** KEY COMPONENT IN 99/4A

One of the key components in the 99/4A is the Texas Instrument's TMS9918A Video Display Processor (VDP). This chip offers features that are not found in any other graphics system.

The TMS9918A VDP interfaces to the host microprocessor (TMS9900) through an 8-bit bidirectional data bus and three control lines. The VDP's output is a composite color video signal, which can be fed directly into any video monitor (you don't have to have TI's) or, with the RF modulator (came with your computer), to the antenna terminals of a television set.

The 99/4A has 16K bytes of dynamic RAM attached directly to the VDP. This video RAM, which contains the data that defines the graphics image to be displayed, is automatically refreshed by the TMS9918A.

The TMS9900 host processor interacts with the 9918A by reading from or writing to its registers or the VRAM.

The 9918A VDP displays an image on the screen that is a set of overlapping

display planes sandwiched together. This distinctive graphics architecture makes possible the simulation of depth relationships between animated objects in the display.

When objects that are on two different planes attempt to occupy the same spot on the screen, the object in the higher-priority plane will be seen.

HOW ABOUT SPRITES?

The 99/4A has SPRITES that can be used from EXTENDED BASIC. A SPRITE is a graphics object of a specified pattern appearing on its plane in a position determined by a single coordinate pair that specify the SPRITE'S location on the screen in the horizontal and vertical axes. By changing the coordinates, the SPRITE can be moved easily and quickly across the screen. The resolution of movement is one pixel on the 192 by 256 pixel area on the screen. The SPRITE plane with the highest priority is SPRITE 0, and the one with the lowest priority is sprite 28.

The ease of programming complex graphic displays through the use of SPRITES in EXTENDED BASIC is a very remarkable feature. The TMS9918A Video Display Processor makes it possible.

SPRITES ARE NOT ALL

The 9918A VDP is capable of considerable graphic feats. This chip has a **Graphics I Mode**. The screen is divided up into a grid of pattern positions arranged in 24 rows of 32 columns for a total of 768 positions. Each pattern position contains 64 pixels arranged in 8 rows of 8 columns. The Graphics I mode is used by BASIC and EXTENDED BASIC.

The pattern definition in the pattern-generator table consists of an 8-byte segment of memory; each bit in the segment corresponds to one pixel in the 8 by 8 matrix; the first byte is the top row of the matrix, and the second byte is the second row, etc. The colors to be used in a given pattern are determined by the two 4-bit values stored in the pattern's color byte in the pattern-color table.

The **Graphics II Mode** allows 768 separate pattern definitions. In addition, instead of only two colors within each 8- by 8-pixel pattern block, this mode allows two colors to be

defined separately for each byte in the pattern block. This mode uses up about 12K bytes of VRAM.

MULTICOLOR MODE

The Multicolor mode is essentially a low-resolution graphics mode. The screen is divided into 3872 blocks, each measuring 4 by 4 pixels, in a 48-line by 64-column format. The color of each block can be any of the fifteen colors or transparent.

TEXT MODE

The TEXT MODE allows the screen to be divided into a grid measuring 24 lines by 40 columns of pattern positions, each of which measures 6 by 8 pixels. The TEXT MODE is used by TI-WRITER WORD PROCESSOR, MULTIPLAN, and TERMINAL EMULATOR II for examples. In this mode the screen has 960 pattern positions that can be filled. The sprite planes are not available in TEXT MODE.

BASIC PROGRAMMING

BASIC is one of many languages your 99/4A speaks and it is not really the mystery that many people think it is. BASIC is easy to use because it uses English words to control the computer.

Your computer actually doesn't possess any intelligence when you first turn it on. When you see the blinking cursor, the computer is just waiting for you to tell it what to do. For instance, when you type in: PRINT "HELLO". The computer will display HELLO on the screen.

When a collection of line numbers and lines are typed into the computer, that collection of information is called a program. A program is just a series of commands that tell your computer what it should do.

SIMPLE PROGRAM

First turn on your computer, choose 1 for TI BASIC, and type in NEW and press the ENTER key to make sure you have nothing in the memory.

Now type in NUM and press ENTER. You are now ready to type in the following simple program for beginners, and don't forget to press ENTER at the end of each line! You don't have to be concerned when a program line runs over onto the next line. You just press ENTER when you're done typing each program line.

```
100 CALL CLEAR
```

```
110 PRINT "THIS PROGRAM CAN"  
120 PRINT "TAKE TWO NUMBERS"  
130 PRINT "FROM YOU, AND"  
140 PRINT "MULTIPLY THEM TOGETHER."  
150 INPUT "WHAT IS THE FIRST  
NUMBER?":N  
160 INPUT "WHAT IS THE SECOND  
NUMBER?":N2  
170 T=N*N2  
180 PRINT "THE ANSWER IS"  
190 PRINT T
```

After typing in this program, type in the word RUN and press the ENTER key. The RUN command tells the computer you want it to execute the program you just typed in.

The computer will ask you for a FIRST NUMBER. Just type in a number and press ENTER. The program will then ask for a SECOND NUMBER. Type it in and press ENTER. The computer will then multiply the first number by the second and print the answer on the screen.

Take a close look at the program. Line 100 CLEARS the screen; line 110 displays THIS PROGRAM CAN on the screen, line 120 puts TAKE TWO NUMBERS on the screen, 130 displays FROM YOU, AND, 140 prints MULTIPLY THEM TOGETHER, 150 allows you to put the first number into computer memory, 160 puts the second number in computer memory, line 170 takes the two numbers from computer memory and multiplies them together, line 180 puts THE ANSWER IS on the screen, and finally line 190 prints the answer on the screen.

In this program you have used some BASIC commands. Whenever the computer sees the word PRINT, it will display on the screen any information that follows if the information begins and ends with quotation marks ("THIS PROGRAM WILL"). If the information isn't in quotation marks and is just a letter, the computer assumes you want it to print a number.

You also used the INPUT statement. This causes the computer to wait for you to provide some type of information from the keyboard. The INPUT command is used when there is information that will be changed every time the program is RUN.

COLOR COMMANDS

Your 99/4A has the ability to change screen colors from built-in BASIC. Try the following little program to demonstrate.

First type in NEW and press ENTER. This will erase any program that might already be in the computer's memory.

Remember to press ENTER after you finish typing each line.

NUM

```
100 FOR COLOR=1 TO 16
110 CALL CLEAR
120 PRINT "THIS IS COLOR"
130 PRINT COLOR
140 CALL SCREEN(COLOR)
150 FOR DELAY=1 TO 100
160 NEXT DELAY
170 NEXT COLOR
```

Now you can type in RUN and press ENTER. Your screen will turn different colors as the program executes. Line 100 lets a numeric variable (COLOR) vary from 1 to 16, line 110 CLEARS the screen, line 120 displays THIS IS COLOR on the screen, 130 displays the COLOR number on the screen, 140 changes the color of the screen, 150 and 160 provide a delay so you have time to look at the color, and finally line 170 tells the computer to go back to line 100 and pick the next COLOR number.

DISK DRIVES

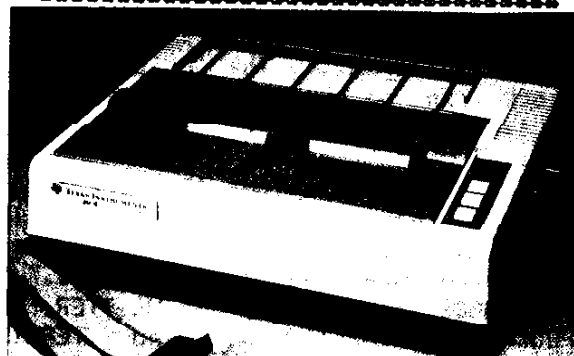
A disk drive will replace your cassette recorder for storing programs and information. You will gain a considerable higher performance and speed. A cassette recorder will take up to 4 minutes to load a 12K program. A disk drive will do it in seconds. A disk drive can also store the information differently than a cassette. It can use RANDOM ACCESS. A cassette, however, can only provide SERIAL ACCESS. A disk can provide both.

Each single-sided 5.25-inch floppy disk can store approximately 90,000 characters of information.

The TI DISK CONTROLLER CARD can control up to three disk drives (single or double sided). Included with the card is a DISK MANAGER 2 command module that performs housekeeping functions for the information that you will store on a disk. These functions include deleting files or programs, naming a disk, initializing a disk, copying a disk, and many more.

Many users have been confused about the DISK MANAGER 2 command module. You don't have to have the module in the computer when RUNNING a program. Many

people think it ties up the command module slot and therefore, they can't use EXTENDED BASIC or some other module while using a DISK. Not true! The DISK MANAGER is only for housekeeping functions.



PRINTERS

A printer can be very useful. Using a pencil and paper to write down records, and information the computer is using grows tiresome very quickly.

You don't have to purchase a TI printer. Almost any printer on the market will work with your 99/4A. All you need is the RS232 card and the correct PRINTER CABLE. The TI RS232 card provides both a serial and a parallel output. Using parallel will normally save you some money on the printer.

Printers can easily be worth the expense. If you use your 99/4A for home financial management, inventory keeping, record keeping, budget management, mailing lists, word processing, or invoices (just about anything but games), a printer can greatly simplify your life.

SOFTWARE

Your 99/4A can use cassette, cartridge, or disk software. Cassette software is usually the least expensive, because it costs less to manufacture. Many people that have disk purchase on cassette. First they read the cassette program into computer memory and then SAVE the program to disk (if the program isn't protected).

CARTRIDGE SOFTWARE

The solid state cartridge software is referred to as COMMAND MODULES. They are the easiest type of software to use because they just plug into the computer and are ready to use. Unfortunately,

they are also usually the most expensive.

DISK SOFTWARE

Floppy disks for your 99/4A are 5.25-inch, flat, magnetic disks. You can purchase many different types of programs in this format. The advantage disks have over cassette is the speed in which you can READ and SAVE a program from disk.

CASSETTE SOFTWARE

Cassette software is loaded into the computer by means of a cassette recorder that is connected to the computer by the cassette control cables.

Cassette software is very popular because it is inexpensive. You do have to have a cassette recorder, but the low cost of the individual cassettes is attractive.

The primary disadvantage of cassette software is the time required to load programs into the computer. The time will vary from one to four minutes, depending on the length of the program.

If the programs have not been protected, it is possible to load in a program from cassette tape and then SAVE it to disk. The user then takes advantage of the low cost of cassette programs and still has the advantage of disk speed after the program has been saved to disk.

99/4A VS. ADAM

After much publicity in the newspapers and magazines the long awaited ADAM from Coleco is out.

The Adam is supposed to be the newest state of the art. Guess what Video Display Processor it uses. The same as the TI-99/4A. The TMS9918A VDP.

The ADAM however, can only display a maximum of 36 characters per line in the text mode. As you know the 99/4A will display 48 characters per line.

How about the built-in word processor for the Adam? Well compared with TI-WRITER it is very slow. A user can type fast into the computer, but if you want to move from one part of the document to another, movement is done via the cursor control keys and can be done either one line at a time by pressing the up or down arrow key or several lines at a time by pressing one of the arrow keys and the HOME key together. But even when you are moving

several lines at a time, the scrolling is very slow. If you are used to the TI-WRITER, it can become quite annoying.

Another annoying feature of the Adam word processor is the fact that in order to implement many of the functions, several keystrokes must be performed. For example, to delete text, you must press the DELETE key, then move the cursor to the first letter of the word to be erased, then press the HI-LITE key, then you use the right arrow key to highlight all of the text that is to be deleted, then press the HI-LITE OFF key and then press either the FINAL DELETE or the DELETE keys. This key pushing makes the word processor quite tedious and hard to use compared to TI-WRITER.

The TI-WRITER only requires pressing two keys to delete anything (characters, lines, paragraphs, all text, etc.). And just in case you make a mistake, you have an OOPS! key that puts it back the way it was before you goofed.

HOW ABOUT RAM MEMORY?

Looking at the spec sheet for the Adam you might think you're getting more of a computer than you really are. The specifications say you are getting 80K of RAM MEMORY. Well, this is true but you must look at how much is available for your BASIC programs after you turn on the power. The operating system and video display take up 54K of the 80K leaving you with only 26K of RAM for your programs. (The same concept is also true for the Commodore 64. See last issue to find out why the 64 only has 39K of usable RAM-ED.) As you probably already know, the 99/4A has 42K usable RAM with the memory card.

The 99/4A leaves more usable RAM because the operating system is stored in the 26K of ROM MEMORY in the console or in the additional 32K of ROM MEMORY if you are using EXTENDED BASIC. The Adam uses up 38K of the RAM just for the BASIC interpreter, the graphics routines and the operating system. The TI-99/4A has all these in ROM memory, thus leaving more RAM for your programs.

Other specs are also confusing. The Adam literature talks about an omni-directional cursor movement capability, the ability of the printer to operate in a bidirectional printing mode, the ability to enter numbers from the controller's numeric keypad, and the

ability of the printer to operate in a background mode. None of these features are supported from BASIC. Almost any printer on the market can hook up with the 99/4A and have bidirectional printing from BASIC. Also most of the printers have small memory buffers that allow operating in a background mode.

The printer that comes with the Adam (you have no other choices) is slow enough as it is, and not having the bidirectional printing capability from BASIC makes a bad situation even worse.

***** GRAPHICS

HCHAR

CALL HCHAR is a subprogram built into the 26K of ROM memory in the console. It is used to place characters anywhere on the screen by specifying the row and column coordinates. The subprogram can also repeat the characters horizontally the number of times you specify. For example:

```
CALL HCHAR(10,9,67)
```

The first number in parentheses identifies the screen row (horizontal) that the character will be printed to. The second character specifies the column position (vertical). The third number in parentheses specifies the character to be printed. It is given in ASCII format (code number). The above example uses 67 which is a C. Therefore, the example will place a C in row 10 and column 9.

You can also add one more number to those already in the above example. It is the repeat number, and is used to repeat the character the specified number of times. For example:

```
CALL HCHAR(10,9,67,4)
```

This command will put four Cs on the screen at row 10 and column 9.

UCHAR

The UCHAR subprogram is identical to HCHAR, except if the repeat feature is used the character occurs in a vertical format.

The following program demonstrates using the UCHAR command to produce a simple bar graph.

```
100 CALL CLEAR
110 FOR T=1 TO 3
120 PRINT "ENTER A NUMBER"
130 INPUT "FROM 1 TO 22-":A(T)
140 NEXT T
150 CALL CLEAR
```

```
160 CALL HCHAR(8,3,42,A(1))
170 CALL HCHAR(11,3,42,A(2))
180 CALL HCHAR(14,3,42,A(3))
190 PRINT "PRESS KEY TO QUIT"
200 CALL KEY(0,K,S)
210 IF S=0 THEN 200
```

***** JOYSTICK REPLACEMENT PARTS

If you have broken your TI joysticks don't despair. TI has replacement parts available. Write to:

TI PARTS DEPARTMENT
P.O. BOX 53
LUBBOCK, TX 79408

***** IBM PCjr VS. 99/4A

Many of the publications are calling the IBM PCjr's BASIC very luxurious. They say the BASIC includes commands that are separate utilities on most other home computers, such as RENUM, TRON, TROFF, FILES, and KILL. Those of you that have had your 99/4A awhile already know that your computer has all these commands built-in also.

The RENUM is NUM with the 99/4A. The TRON is TRACE. TROFF is UNTRACE. FILES is Just listing a directory from the DISK MANAGER, and KILL is DELETE from BASIC or EXTENDED BASIC.

The PCjr's built-in ROM BASIC is 32K bytes long. The 99/4A's built-in ROM BASIC is 26K bytes long. Only 6K bytes shorter and a lot less expensive.

The PCjr's EXTENDED BASIC cartridge adds another 32K of ROM BASIC. The TI-9/4A's EXTENDED BASIC cartridge adds another 32K of ROM BASIC. Both are the same byte size. However, the 99/4A's EXTENDED BASIC is only \$99.00.

***** CARTRIDGE PROBLEMS

If you have had your 99/4A for 6 months or more, you may have experienced computer lock-up when using the command modules. The most likely cause is dirty contacts on the cartridges. To prevent this, you should occasionally clean the contacts. Manually depress the spring-loaded cover where the cartridge fits into the slot. You will see an edge with contact strips on it. Take a cotton swab moistened with either contact cleaner fluid or rubbing alcohol and rub the contacts gently with the swab. Allow a few minutes to dry, and your cartridge will be ready to use.

SECOND DISK DRIVE

For those of you thinking about adding a second disk drive, it is not necessary to purchase TI drives.

You may want to consider the TANDON TM 100-2 for your second drive if you want double sided capability. Or the TM 100-1 if you want single sided.

The TM 100-2 utilizes 80 tracks per diskette (40 per side). The heads are guaranteed for up to 20,000 hours and the track-to-track access time is only 5 milliseconds.

The drive is quite reliable and is reasonable priced. You can find them advertized for around \$250 including the power supply. IBM uses it for the PC.

By using the DISK MANAGER II command module to initialize a diskette, the TM 100-2 provides you with about 180K bytes of storage.

NEW TI COMPUTER

TI has introduced a portable computer fully compatible with the desktop TI PROFESSIONAL COMPUTER. It has a built in 9-inch color or monochrome display, easy to use keyboard, high resolution graphics, and memory expansion up to 768K bytes of RAM.

All the software available for the PROFESSIONAL is compatible with the portable. Shipments began in January with a suggested retail price of \$2395 for the monochrome display unit with one disk drive and \$2965 for the color unit.

TI HOME COMPUTER PROGRAMS AND NEWSLETTER

TI-99/4A PROGRAMS- You may purchase programs for as low as **\$2.00** per program if ordered individually. Or purchase them by **SET@** and get them for only **\$1.00** each -no tricks, no gimmicks! And you don't have to be a subscriber to the **NEWSLETTER**.

PROGRAMMING CONTEST- If you have written your own programs, now is your chance to win a prize.

- 1st PRIZE- \$175.00 worth of TI and Atarisoft programs.
- 2nd PRIZE- \$100.00 worth of TI programs.
- 3rd PRIZE- \$ 75.00 worth of TI programs.

An official entry form must accompany each program that you submit. To request your entry submission form, call (602) 893-0108 or write to ARIZONA 99 UG, 4328 E. LaPuente Ave., Phoenix, AZ 85044 .

COMPUTER TUTORING- If you need help with learning BASIC, EXTENDED BASIC, or TI-WRITER, you are in luck. Classes are being set up now (both private tutoring and group classes). Call 893-0108 for more information.

NO RISK NEWSLETTER OFFER- Enter a trial subscription at no risk. Satisfaction is guaranteed or the unfilled portion of your subscription will be refunded. The **NEWSLETTER** has hard to find information exclusively for the TI HOME COMPUTER. Each issue contains programming tips, small programs you can type in, programming techniques for beginners, intermediate-level users, and advanced. Now that TI is out of the computer business, the **NEWSLETTER** will be even more valuable to you. You will receive six **NEWSLETTERS** per year for only ---~~\$8.95~~.

PROGRAM ORDERING INFORMATION- With every **\$8.00** order for programs you will receive a free programming tips sheet that will help you get the most out of your computer. The tip sheet has hard to find information that has been accumulated over the past two years. Normally your order for programs will be mailed out to you the very same day the order is received.

ARIZONA 99 UG ORDER FORM

NAME: _____ NEWSLETTER SUBSCRIPTION _____ \$8.95/YR.

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