



# BITWARE

By Vaughn Software

For the

TI-99/4A COMPUTER

cover art by BITMAC

## WHAT IS BITMAC?

BITMAC is the largest and most comprehensive graphics program ever produced for the TI-99/4a computer. BITMAC graphics are totally unlike the usual graphics you see on the TI-99/4a. With BITMAC you can place "dots" on the screen in any position and in one of 16 colors. You can print text ANYWHERE, even on top of existing text! You can print text sideways, upside down, in mirror image, in 16 colors and a multitude of other ways. But BITMAC text is only a small part of this very large program. Other features of BITMAC will allow you to do things like SIGN your name, make perfect circles ANYWHERE, draw lines from any point of the screen to any other point, make perfect rectangles in EXACTLY the position you want them and much more!

There is a very wealthy set of options to get your graphics out of the computer and into the "real world". If you have all the disk drives your computer can support, BITMAC can use them. If you have four printers connected, BITMAC can use them, if you have a monochrome monitor BITMAC will tailor itself to show crisp clean monochrome graphics.

BITMAC has provisions for trackballs, joysticks and even a second computer input! If you have a second computer such as an IBM PC, an Apple Macintosh even an IBM 370 main frame there are provisions for your second computer to create graphics with BITMAC!

But what's it for?

Only you can answer that. BITMAC can make "slide presentations" for group meetings (and print the graphics for their newsletter!), give hours of "just doodling" pleasure, create charts for a stock holder report, print camera ready art for business ads, make still cartoon sequences (and print them in one of two sizes), create mechanical drawings, draft floor plans and many other uses! With a second computer, BITMAC can plot satellite data, statistical data, computer generated art plots, analog sampled data and just about anything your second computer can throw at BITMAC.

BITMAC offers BOOLEAN disk input (just like NASA enhances photos!) and a wealth of computer enhancement techniques that lend raw Power to your ability to manipulate bitmapped graphics. It sounds difficult to use doesn't it?

BITMAC offers icon input that allows you to Point at the functions you want. Nothing was spared in making BITMAC easy and simple to use. Even a child will find BITMAC entertaining and above all EASY TO USE. The "computer wise" will find BITMAC a very productive tool and a refreshing change from the cryptic relationships they may have had with simple screen editors. For the real computer Pro, the coprocessor link will allow you to implement all the programming knowledge you can muster and put that power to a bitmapped screen.

BITMAC is written entirely in TMS9900 machine language and runs at "warp speed" at all times. It's a product of several years of very intensive development. We challenge you to find a superior graphics Program for the TI-99/4a! Go ahead and look around. Try the others first if you like. THEN LOOK AT BITMAC. We think you'll agree, BITMAC is an almost effortless program that allows you to work with bitmapped technology in a way no other program can, at an affordable price and with provisions for your future hardware that no other TI-99/4a program can offer. We are promising nothing short of astounding and BITMAC DELIVERS! BITMAC requires either the MINI MEMORY MODULE, EDITOR ASSEMBLER MODULE or the EXTENDED BASIC MODULE, a DISK DRIVE SYSTEM, MEMORY EXPANSION and JOYSTICKS.

#### LOADING BITMAC

BITMAC is loaded by placing the program disk in drive 11. The Editor/Assembler, Mini Memory or Extended Basic module must be in place.

1. turn off the computer for more than 30 seconds
2. turn on the computer
3. press <2> twice (<3> for MMM)
4. press <3> once (<1> for MMM)
5. at the prompt "FILE NAME" type "BITMAC"
6. and press <ENTER>

The Program will self start after it is loaded. To load BITMAC with the Extended Basic module, follow steps one and two above then press <2> twice with the BITMAC disk in disk drive number one.

To insure Proper operation the computer MUST be turned off and then on before BITMAC is loaded. Even the Texas Instruments title screen is no assurance that the computer is properly initialized! BITMAC may appear to be operating properly for some time, however the input output functions will not properly operate. In addition, BITMAC will not operate properly if loaded with a CALL LDAD statement from BASIC language. BITMAC must be the first and only information given to the computer after the computer is placed in operation. If BITMAC does not operate Properly with the MINI MEMORY module, It may be necessary to use the CALL INIT command from basic to clear the MINI MEMORY module prior to loading.

For linking BITMAC with companion programs from VAUGHN SOFTWARE, please see the loading instructions that are included with these programs.

## BITMAC 2.0 GENERAL OPERATION

BITMAC is operated by pointing at visual objects called "ICONS". Pointing is done by means of a joystick or trackball. To "activate" an icon, press the fire button. This "point and fire" method is used in all sections of the program with the exception of TEXT mode, DRAW mode and Input output device selection. These features will be discussed later. At the program start, the main icon selections will appear. These icons, from top to bottom, have these functions:

- 1 SLIDE SHOW
- 2 DRAW
- 3 COMPUTER ENHANCE
- 4 COPY
- 5 LINES
- 6 CIRCLES
- 7 RECTANGLES
- 8 TEXT
- 9 COLOR

The icon at the bottom left of the screen serves two functions. It shows the current program mode and it serves as a pathway to the previous icon set. By activating this icon you will be returned to the previous program mode.

While a function is active, the fire key may be interpreted in one of three ways: Click, double click and drag. The click is characterized by a single quick "stab" on the fire key. The double click is characterized by two quick stabs on the fire key. The drag is characterized by a press and hold action. Some program functions use all three types of key presses while others ignore the difference between key presses.

Throughout the program, if a difference between key Presses is allowed they are interpreted as: CLICK=Place second reference Point, DRAG=start selected function, DOUBLE CLICK=activate color drawing. If the three types of presses are not allowed, any press of the fire key will be considered as an order to activate a function. Until you are familiar with the program, it is best to use the DRAG motion. Functions that use the drag motion allow you to position graphics on the screen before the fire key is released. In selecting an icon, differences between fire key presses are always ignored.

The joystick or trackball are ignored in the following situations: Input/Output device selections (which are menu prompted), Text mode (keyboard entry). From the text mode, the <ENTER> key returns joystick and icon control. From input/output selection, joystick control will be returned by aborting the input/output function or completing the input/output function.

In the Draw mode the joystick/trackball and fire key serve as a means to place bits on the screen. All program controls in the draw mode are entered by means of the keyboard. In all modes, except text and input/output selection, the cursor location can be reported. To report cursor x and y location press <R>eport. To turn off the reporting feature press <O>ff.

## BITMAC PERIPHERAL DEVICES

The peripherals that BITMAC supports or for which there are special provisions are:

- Disk drives (1-5)
- RS232 (1-4)
- PIO (1-2)
- Monochrome monitors
- Color monitors
- Wico trackball (TI type or adapted)
- Joysticks (TI or adapted)

Required equipment for BITMAC 2.0 is:

- Memory expansion (32 or 128k)
- Disk storage system
- Editor Assembler, Mini Memory or Extended Basic module
- Joysticks
- TI-99/4A computer system (TI-99/4 not supported)

Printers supported on the RS232 or PIO ports are Texas Instruments, Gemini or Epson type with Graftrax type dot graphics support.

Disk files created by BITMAC can be manipulated with the Texas Instruments DISK MANAGER Module (versions I and II) or used by user created FORTH and ASSEMBLY language programs. These Disk files are also suitable for modem file transfers by Terminal Emulator programs.

## SLIDE SHOW

The SLIDE SHOW icon is the top icon and allows you to work with previously created BITMAC drawings on disk. "Slide show" essentially describes what the function does.

By selecting the "SS" icon, a message will appear on screen prompting you for a list of "slides" and the order in which you would like them presented. The "slide" names are the letters "A" through "z" and correspond to the disk file names "SCREEN/A" through "SCREEN/z". Up to 26 slides may be selected for presentation.

If you specify a list: ADCBE@ Then screen A from the disk will be shown followed by D, C, B and E. The "@" character means "END OF LIST" and upon reaching this character, the computer will start again at the beginning of your list.

If you make a mistake while typing the list, keep typing letters until the cursor ""wraps around" the list and is in the first position or use <FCTN S> to backspace and then make your corrections. Make sure that at the end of your list the "@" character is Present.

The message will also remind you that to stop or abort the SLIDE SHOW you will need to press <9>. If the computer is busy with the disk drive, your abort command may not be immediately recognized. It is advisable to press and hold the <9> key.

After SLIDE SHOW is aborted, the screen will flash but the drawing will remain on screen. At this point BITMAC is waiting for your permission to replace the texcons on screen. Press the fire key to continue.

SLIDE SHOW offers both auto run and manual presentation. After you have entered your slide list the prompt: <A>uto or <M>anual will appear.

With the AUTO run selection, each slide" will be shown for approximately one minute before the next "slide" will appear. No messages will appear until SLIDE SHOW is aborted and the texcons appear.

With the MANUAL run selection, the disk file name will appear for a moment before the next "slide" appears. In MANUAL the fire key will load and display each "slide" in turn. By pressing and holding the fire key, maximum speed is achieved. This method aids in Previewing disk files for other operations.

#### CAUTION!

DAMAGE CAN OCCUR TO THE DISK DRIVE IF AUTO RUN IS ALLOWED TO FUNCTION UNATTENDED. DISK DRIVES ARE NOT INTENDED TO RUN CONTINUOUSLY FOR LONG PERIODS OF TIME. FOR APPLICATIONS THAT REQUIRE DAILY LONG HOUR USE OF SLIDE SHOW, IT IS RECOMMENDED THAT YOU CONTACT THE DISK DRIVE MANUFACTURER OR TEXAS INSTRUMENTS TECHNICAL SUPPORT SERVICES.

If a disk error occurs while SLIDE SHOW is operating. SLIDE SHOW will stop functioning and an error message will appear on screen. Press <9> to abort the function.

After SLIDE SHOW is terminated, you are always returned to the VAULT. This will allow you to do other I/O operations without returning to the main icon set.

SLIDE SHOW only operates with disk drive number one.

## DRAW MODE

The draw mode is the "freehand" mode. If the graphics you wish to draw do not lend themselves to circles, rectangles or lines, you will find the draw mode useful. The joystick/trackball becomes a pencil to Place bits any where you like, even where the icons are! The draw mode works primarily through keyboard input. You should become familiar with these key functions and memorize them if possible.

Allowed keyboard inputs: (All in lower case)

- <Z,X,C,V,B> The cursor speeds (Z Is the fastest)
- <N> draw with SOLID bits
- <M> draw with ERASE bits
- <,> (comma) Selected color on
- <.> (period) Selected color off
- <R> report cursor location
- <A> arrow shaped cursor
- <S> crosshair shaped cursor
- <D> multiple cursors
- <F> single cursor
- <G> cursor color
- <Q> swap bits
- <1> through <9> brush size
- <FCTN 5> printer dump
- <FCTN 0> save copy in computer
- <FCTN 8> replace screen with computer's copy
- <ENTER> return icon control
- <FCTN ARROWS> single bit scroll
- <FIRE> place bits on screen
- <FCTN => QUIT (only from DRAW MODE)

You'll notice that the Speed keys for the cursor are all at the bottom left of the keyboard. Just to the right of these keys (N and M, comma and period) are the controls for the type of bits to be Placed on the screen. Above the cursor speeds (A,S,D,F and G) are the controls for the type of cursor you like. Because these keys will be used often, they are placed in "geographical" order. The other functions have been distributed on the keyboard. These keys affect your on screen drawing or your computer system function. Before using these keys you should think about how they will affect your drawing. The "store" function <FCTN 0> will store an ""approved" stage in your drawing. This function works well with <FCTN 8> (redo) to erase graphics from the screen.

However, if you have not used the store function, the computer's copy of your drawing may be rather old. You could erase a lot of hard work! The computer takes a "copy" of your drawing each time a new set of icons appear as well as when you use <FCTN 0> in the DRAW mode. A function similar to <FCTN 8> is available from CIRCLE, LINE, and RECTANGLE by pressing the spacebar. <FCTN 8> in the draw mode will replace screen colors and patterns with the computer's last copy. The spacebar version, available in other modes, operates on patterns but not colors.

A printer dump can be achieved by using <FCTN 5>. Before using this function you need to use the VAULT icon to specify your printer interface.

The X Y location of the cursor can be reported with the <R> key and the report can be erased with the <O> key.

The limits of the "X" dimension (left right) are 0=far left 254=far right. The "Y" (up down) limits are 0=top 192=bottom.

The <N> key and the <M> key are available from the draw mode, and other areas of the program where you will be placing graphics.

The <N> key tells BITMAC to place solid bits in your drawing. The <M> key tells BITMAC to use erase bits. If while you are drawing, you cannot see what is being placed on the screen, press <N> for solid bits. If you need to erase sections of your drawing, press the <M> key and erase sections of the drawing with the joystick and fire key. (Remember to press <N> when you are through.)

The keys <1> through <9> will allow you to change the width of the lines placed in draw mode. When you first enter DRAW, the program is on setting 11. With setting 11 the line placed by joystick and fire key movement is as narrow as possible. Setting 19 is the widest line. The number of the setting indicates the width of the line in bits. Setting 12 gives 2 bit wide lines, setting 3 gives 3 bit wide lines and so forth. The width of the lines you place will effect the speed at which you can draw. While using the larger line widths, it is suggested that you use cursor speeds <Z> or <x>.

The <period> and <comma> keys control the placement of color on the screen. When BITMAC is first started, all the solid or "on" bits are black and all the erase or "off" bits are clear. If you specify another color option with the color icon, <period> and <comma> will make your colors available for use. While color is on, a square will appear in the bottom left hand corner of the screen. COLOR IS PLACED WITHOUT THE FIRE KEY! If color is on, any movement of the joystick will place color. If you press the fire key and move while color is on, you will also place bits on the screen.

The <Q> key performs the same function as the "swapbits" function from the enhance icon. Its function can be reversed by pressing the key a second time. All "on" bits will change to "off" bits and all "off" bits will change to "on" bits. This function is useful in planning color placement and in printer dumps. PAGE 8

The <ENTER> key, as well as the icon in the lower left corner, places the program under icon control and restores the main icon set to the screen. The four arrow keys, when used with the FCTN key will allow you to scroll your drawing by a single bit in any of four cardinal directions. The scroll functions work very well in special graphics effects using the Boolean operators from the vault icon. Scrolling affects only the bit pattern of the drawing and not the color information. This is useful in arranging screen drawings on the 8 bit boundaries allowed for color in the TI-99/4A computer.



## COMPUTER ENHANCE

By selecting ENHANCE, you will see the first "TEXCONS". Texcons are icons that convey their message through a textual message. (TEXT iCONS) They differ from ordinary text messages in that they also are the instrument that activates the function they offer. In BITMAC, all texcons are bounded by solid blocks. The texcons and functions available from the computer enhance icon are:

LIFE 1  
LIFE 2  
SWAPBITS  
ENLARGE  
REDUCE  
FILL  
ROTATE  
MIRROR

To activate a texcon, move the cursor to the left side of the texcon and press the fire key. The right side of texcons are not sensitive to the cursor.

The key operated options in ENHANCE are: <Z> fast cursor, <B> slow cursor, <R> report X Y, <O> turn off X Y report and <SPACE BAR> erase results of function (available with FILL only). For a very slow cursor speed, use both <R> and <B>. Remember to use <Z> to go back to the fast cursor.

LIFE 1 and LIFE 2 perform similar functions. They only vary in the directions they use to operate. The life functions do a "population survey" in the area you have selected and decrease or increase bits in the area. The functions serve to average the number of bits. They lend texture to a drawing.

To point out the area for these functions, the computer will need two points of reference. One will be invisible and the other will be the cursor location. To set the invisible point, move the cursor to its intended location and "CLICK" the fire key. (The CLICK is a fast press and release.)

After setting the invisible point, we'll call it the <P> point, move the cursor away and then "DRAG" the fire key. (The DRAG is a press and hold motion) You'll begin to see why we need the invisible <P> point! DON'T RELEASE THE FIRE KEY YET!

A "fluid" rectangle will appear. This rectangle will respond to movements of the joystick by changing shape. The boundary of this rectangle will describe the area that the LIFE function will operate on. Hopefully you have moved the rectangle over an area that contains a few bits that are on. Unless there is a population of bits in the area, the LIFE function will appear to do nothing.

To stop the action of the LIFE functions, press the fire key once more.

The <P> point and the fluid rectangle are used throughout the program. Unless you have chosen the rectangle function, a rectangle always gives the program an area for another function to work with.

## SWAPBITS

The SWAPBITS function operates immediately. There is no <P> point to define or rectangle to create. The SWAPBITS function turns all the "on" bits "off" and all the "off" bits "on". It is useful for placing print in a solid "on" area, visualizing color placements and graphic effects. The function will reverse itself through a second use. The <Q> performs the same function in the draw mode.

## ENLARGE

The ENLARGE function is initiated in the same way that the LIFE functions are. You must place the <P> point with a CLICK of the fire key and position the fluid rectangle. When you release the fire key, the area inside the rectangle will increase in size.

The ENLARGE function also creates texture but in a more predictable fashion than LIFE. This function works well with the copy function to vary texture in drawings.

The REDUCE function uses the fluid rectangle also. The function serves to decrease the size of objects. (Or the entire screen!)

ENLARGE and REDUCE are not available while color is active. This is because the function uses areas of the computer ordinarily reserved for color. If you must use this function and color is active, you will need to erase the colors from the screen with the brush icon.

## FILL

The FILL function will fill an area with "on" bits. There is no need to place a <p> point or work with the fluid rectangle. It fills areas that are bounded by "on" bits. The function will work repeatedly until you select the icon at the lower left of the screen.

To best utilize FILL, it is a good idea to understand how it operates.

When you Press the fire key, the cursor will "look" up, down, left and right. If it "sees" a bit that is on, it will quit looking in that direction and remember the distance to the bit that was on. The cursor looks directly at zero degrees, 90 degrees, 180 degrees and 270 degrees. The bit that it sees in each of these directions will define the limit of the filler. If the FILL routine gets out of the intended area, it seldom destroys the drawing. A mistake can usually be remedied with one of the erase functions or the DRAW mode with blank bits. The usual reasons for a mistake are filling an area that is not truly enclosed and "missing" the icon when you wish to return from the function.

## ROTATE

The ROTATE function uses the <P> point and the fluid rectangle. Its function is to spin or rotate the area inside the rectangle. If the area you select for rotation will not fit on the screen after rotation, it will be clipped to fit the screen. All rotation is to the right in 90 degree increments. The ROTATE function is unavailable while colors are active. If you must use the ROTATE function and colors are on the screen, you will need to erase them with the BRUSH icon.

The double click is not used with any of the computer enhance functions. To return to the main icons, keep selecting the icon in the lower left of the screen.

The MIRROR function works in a manner similar to rotate. You will be working with the fluid rectangle and the invisible <P> point. The area within the rectangle will become a left to right mirror image. When MIRROR is used in conjunction with ROTATE a mirror image in any of the four cardinal directions can be produced.

## COPY

The copy icon allows the on screen reproduction of areas in your drawing. The copy function is a two step operation.

Step one is similar to the ROTATE, MIRROR and other functions in that you need to specify a rectangular area from which to take the copy. This is done by clicking the fire key to place an invisible point, dragging the fire key and moving the joystick to place a fluid rectangle and releasing the fire key to "approve" the area for use by the function.

In step two you will place the copy in the desired screen area. Before you start step two, you will find that the cursor is now limited in its screen movement. At this point the cursor is "carrying" your copy. The limits of screen movement are created by the dimensions of the copy the cursor is carrying. To abort the function, click the fire key to "drop" the copy and select the return icon in the lower left corner.

Step two is started by dragging the fire key. A fluid rectangle will appear on screen. The size and shape of this rectangle are the same size and shape as the copy. Simply move the rectangle to the desired area and release the fire key. Your copy will be placed. After you have started "dragging the copy" the function cannot be aborted.

Step two is repeated over and over again until you "drop" the copy with a click of the fire key. This will allow you to start again with step one.

By visualizing the methods that BITMAC uses to make a copy, you can change the outcome of the copy. BITMAC acquires the information for the copy from the area of the screen you have specified in step one. BITMAC "reads" the area from left to right, top to bottom. (In the same way we read.) BITMAC also places what it "reads" into the area you have specified in step two. If you overlap the two areas, BITMAC may be reading the same thing it is placing on the screen! To avoid this, when overlapping these two areas, make sure that the area specified in step two is slightly higher on the screen than the area you specified in step one. In this way BITMAC will always be "reading" just a little ahead of the place where it is writing.

The copy function can be operated repeatedly until you drop the current copy and activate the icon in the lower left hand corner of the screen. (Which returns the main icon set.)

### LINES

By selecting the line icon, BITMAC branches to the line drawing function. just as with LIFE, REDUCE, ENLARGE and other functions in BITMAC, Line needs two points of reference. The point to start the line and the point to draw to.

By using the CLICK, you can place the invisible "P" point. The computer will then draw all lines to that point Until a new "P" point is selected with a click.

With the LINE function, the fire key also uses DRAG and DOUBLE CLICK. The drag sets a fluid line in motion that will "freeze" solid when you release the fire key.

The DOUBLE CLICK will turn on your selected colors for use with LINE. When the colors are active, a color block will appear next to the icon in the lower left hand corner.

It is important to practice the fire key actions and to be aware of the color block!

The line function will also work with blank or erase bits. If you cannot see a line being drawn, and you wish solid bits, exit the line function and select SOLID BITS from the SCRUB BRUSH icon or the <N> key from draw mode.

For most drawings, LINE is an excellent place to start. Most graphics are made from intersecting lines in some way. Mountains, charts, boats, planes, floor plans and landscapes all are comprised mostly of lines. For this reason, you should consider LINE as a starting point in your graphics.

With color on, you can use a fluid line to "sweep" an area and fill it with color. You can also erase existing lines by using erase bits.

There are several key functions available in LINE, RECTANGLE and CIRCLE. They are <N> solidbits, <M> erasebits, <R> report X and Y, <O> turn off X and Y report, <SPACEBAR> erase last bits placed, <Z> fast speed and <B> slow speed. If you need a slower cursor speed, use both <R> and <B>. Remember to use <Z> to go back to the fast cursor speed.

The <SPACEBAR> function is similar to <FCTN 8> in the draw mode, however this function does not change colors on the screen. If you have drawn a line that you wish to erase, the <SPACEBAR> should be used before you touch the fire key again. By touching the fire key to place the "P" point, elect color operation or place another line, BITMAC assumes that you are satisfied with what is on the screen so far.

To exit the LINE function, activate the icon at the lower left of the screen.

### CIRCLE

The circle function is started in a manner similar to RECTANGLE and LINE. Both click and double click are allowed. For a complete description of click, double click and the functions they provide, please see LINE.

The diameter and placement of circles in BITMAC depend on several items. The diameter of the circle will be the same as the left and right distance between the cursor and the invisible <P> point (X dimension distance). The center of the circle will always be halfway between the invisible <P> point and the cursor. (Both X and Y dimensions are considered.)

When using the FILL function with circles, it is best to place the cursor directly at the circle's center. In addition you should insure that the circle is not missing bits. If you fill a circle with missing bits, four small "tails" will appear on the circle as the filler escapes.

The available key functions are <N>, <M>, <R>, <O>, <Z>, <B> and <SPACEBAR> which are discussed in the LINE section.

The CIRCLE function, when used with ERASE BLOCK and ROTATE, will provide a source of arcs and bent lines in your drawing.

## RECTANGLE

The RECTANGLE may be the most often used object in BITMAC. RECTANGLE is used with most functions that require an area to operate on.

To place a RECTANGLE, two points of reference are required by the computer. One will be the cursor and the other an invisible point placed with a click of the fire key.

To draw the RECTANGLE, drag the fire key and move the cursor. The RECTANGLE is not placed in your drawing until the fire key is released. The RECTANGLE function may be repeated until the icon at the lower left of the screen is activated.

RECTANGLE recognizes the double click as a command to activate your color selection. However, because RECTANGLE works on such a large area of the screen, it is recommended that you do not place color with the RECTANGLE function.

The available key functions are <N>, <M>, <R>, <O>, <Z>, <B> and <SPACEBAR> as discussed in the LINE section.

## THE SCRUB BRUSH

The SCRUB BRUSH offers several options to erase your graphics. ERASE SCREEN COLORS erases all the current information on graphics except the screen color.

The COLOR texcon allows you to erase only the information related to color. This selection also reinitializes the color buffer.

The BLANKBITS texcon allows you to draw with bits that erase "on" bits from the drawing.

The SOLIDBITS texcon sets all further bits placed to an "on" or solid appearance. This is the normal state of the program and reverses the action of BLANKBITS. If you cannot see the bits you place, SOLIDBITS is the usual solution.

The BLOCK texcon allows you to erase blocks of graphics by defining a rectangular area for the function to operate on. The rectangle area is specified in the same way as for REDUCE, ENLARGE, ROTATE and MIRROR. The key functions available with BLOCK are <R>, <O>, <N>, <M>, <Z> and <B> as discussed in the LINE function.

The actions of these functions, except for ERASE BITS and SOLIDBITS, are generally not reversible. If you are in doubt as to the outcome of your selection, it is a good idea to copy your drawing to disk first.

The BLOCK erase function only works with the bit patterns on the screen and not with their specified colors. BLANKBITS may alter the appearance of the colors by erasing "on" bits, however the colors in the area where BLANKBITS are used will remain.

## THE VAULT

The VAULT icon is BITMAC's pathway to the outside world. The VAULT icon offers controls for the display monitor, joystick, printer and disk drives. For business use, this is the icon that makes BITMAC useful.

The texcons available from the VAULT icon are:

STANDBY  
IN/OUT  
MONO  
COLOR  
JOYSTICK 11  
JOYSTICK 12  
PRINT  
COPROCESS

We'll save IN/OUT for the latter part of this section.

STANDBY places the monitor in a waiting configuration. The screen goes blank and BITMAC waits for a key press to signal your wish to start the program again. STANDBY is useful when the program will be left unattended for some period of time. If you have had your TI-99/4A for a while, you will notice that the screen will go blank if the computer is left unattended. In BITMAC this does not occur. It is sometimes felt that a monitor should not display the same image for long periods of time. This is to protect the phosphor in the monitor's CRT tube (picture tube). The STANDBY mode offers this protection without the screen going blank during presentations of your graphics. Under ordinary use, the STANDBY texcon will not be needed.

MONO means "monochrome". The MONO texcon is specifically for use with green, amber and black white monitors. The MONO texcon sets the screen color to black and the bit "on" color to white. Color selections are still allowed from the color icon, only the initial screen colors are changed. In addition MONO COLOR texcons reset the computer's color buffer to allow the ROTATE, ENLARGE REDUCE functions once more. (These functions are not available with color on the screen, please see the COMPUTER ENHANCE section). COLOR Performs a similar operation to MONO except that the screen color is clear and the "on" bit color is black. Selecting the COLOR texcon resets the color buffer just as with MONO. COLOR configures BITMAC to operate with a color monitor. The BITMAC program starts in the COLOR configuration.

JOYSTICK 11 and JOYSTICK 12 texcons change the joystick number that will be used by the program. If you are using a trackball JOYSTICK 11 should be correct. The program starts with joystick port 11 active.

## IN/OUT and PRINT

The IN/OUT texcon will allow you to operate the disk drives and the printer ports. Before using the PRINT texcon, the IN/OUT texcon must be used at least once to specify your printer interface. If you select the PRINT texcon without first establishing the printer port, the screen will flash but nothing else will occur.

After selecting the IN/OUT texcon, a menu will appear. Until the texcons appear again, the program is under keyboard control and the joystick/trackball ignored.

The menu selections are:

- 9 ABORT
- 1 DUMP TO PRINTER
- 2 SAVE TO DISK
- 3 REPLACE SCREEN
- 4 AND SCREEN NO COLOR
- 5 OR SCREEN NO COLOR
- 6 XOR SCREEN NO COLOR

ABORT <9> is available from at anytime that a disk drive is not in operation. ABORT can be used while a printer is operating with some limitations.

### DUMP TO PRINTER

The printers supported by BITMAC are the GEMINI, EPSON and TEXAS INSTRUMENTS type dot matrix printers. If you have another type of printer, BITMAC may not support its operation.

After selecting DUMP TO PRINTER, you will be asked if you want a large print or a small one. Press the appropriate selection. REMEMBER: if you change the size of print, you must cycle your printer off then on again to reinitialize the printer's buffer. With repeated prints of the same size this will not be needed. The PRINT texcon and <FCTN 5> in the draw mode always print with the small size dump. To elect the large dump, you will need to use the IN/OUT texcon in the VAULT.

After you have selected the size of print you wish, a menu will prompt you for an RS232 or PIO port. Enter the selection that describes your printer interface. If you have chosen an RS232 port, rather than PIO port, you will be prompted for the RS232 baud rate. This is the speed that data will be sent to your printer. The selection for baud rate is dependant upon your printer. If you consult your printer manual and do not find a baud rate specification, try several speeds. The speed to use is the fastest one that allows reliable print.

If you must test several baud rates, there are two things that BITMAC should NOT make your printer do: form feeds (scrolling empty paper) and sounding the printer's bell. If either of these occur while testing different baud rates, the rate you are using is probably too fast.



At this point your printer will be assigned to <FCTN 5> in the draw mode and to the PRINT texcon. printing will then start. Your selection will also be remembered for the next time you select DUMP TO PRINTER from the vault. On later use of DUMP TO PRINTER you will be asked if you wish to use the same printer port. From the PRINT texcon and <FCTN 5>, only the small dump is available.

The screen goes black while the printer or one of the disk drives is operating. This is because BITMAC uses the "screen memory" (VDP RAM) to talk to the peripherals. Screen dumps from BITMAC are not actually from the screen, the data is stored in general CPU memory.

The small screen dump places exactly one dot on the paper for each dot in your screen drawing. This type of print is optimized to represent the most accurate image possible and is much faster than the large print. To obtain the best results with this dump it is recommended that you use a new, but not "wet" printer ribbon.

The large screen dump is optimized for the best possible reproduction characteristics and is done with a type of "double strike". Because of the great amount of work a printer must do to achieve this reproduction quality, the large dump takes a considerable amount of time. Differences between printers will create a difference in the final print size and its proportions.

This is because of the printer's accuracy (or lack of accuracy) in line feeds and head motion. Noticeable differences may be seen even between printers of the same make and model. However, the large screen dump is designed to take best advantage of printer variances. The large screen dump works best with a well used printer ribbon. If it is used with a new ribbon, smudging may result.

For either screen dump, it is best to insure the printer paper feeds very easily through the printer. The tolerances used in these screen dumps are as small as 1/144th of an inch! Any binding in the paper feed will be noticeable.

If you decide to abort the screen dump, Press and HOLD <9> until BITMAC restores your drawing to the screen.

After printing is finished, your drawing will be restored to the screen. Press the fire key to restore program operation. The PRINT texcon, and <FCTN 5> in draw mode, will start a screen dump using the port descriptions made in the IN/OUT section.

## SAVE TO DISK

BITMAC offers two options for saving your drawing to disk; color and monochrome. A monochrome screen consumes 26 sectors on the diskette and the color screens consume 50 sectors. The disk file names used by BITMAC are SCREEN/A through SCREEN/z. No files, except those created by BITMAC, should use these names on your diskette. Monochrome and color screens may be mixed on the same disk. The screen color (backdrop color) is saved on monochrome disk files, however, bit color is not.

If you intend to use the DISK MANAGER module with your screen files, it is a good idea to limit your screen letters to A through Z. The disk manager module does not work well with lower case letters.

To save your screen drawing, select SAVE TO DISK and you will be prompted for the color information, disk number and screen letter to use. If you have previously made a disk drive and screen selection, these selections will be displayed. To select them once more, press then <ENTER> key. If you elect to use another disk drive or screen, press the key that represents your selection.

If an error occurs, an error message will appear and you will be asked to press <9> and abort the disk operation. The error codes can be found on page 55 of the Mini Memory manual or page 299 OF THE EDITOR/ASSEMBLER manual. The usual error codes and the usual reasons for them are:

error code	usual reason
0 -----	ADDRESSING A NON EXISTANT DRIVE
1 -----	WRITE PROTECT NOTCH COVERED
2 -----	ATTEMPTING TO RETRIEVE A SCREEN THAT IS NOT ON THE DISKETTE
4 -----	DISK IS FULL
6 -----	DRIVE DOOR OPEN OR NO DISKETTE IN THE DISK DRIVE

If you will be using BITMAC for presentations, it is a good idea to plan the disk space you will need. On a double sided single density disk, all 26 screens are available when monochrome is selected. If all of the screens were saved in full color, only 14 will be available.

The record type BITMAC uses is INTERNAL, FIXED 128. In order to use these files in user created programs, assembly or forth languages will be required. However, BITMAC created files can be manipulated with the Disk Manager module.

## REPLACE SCREEN

There are several options for recovering graphics from diskettes. The REPLACE SCREEN function simply replaces the current screen drawing with one from the diskette. This is the only option that allows both color and monochrome input from the diskette.

## BOOLEAN DISK INPUT

The other three disk input options produce special graphics effects. The effects are created using the Boolean operators "AND", "OR" and "XOR. These operations allow you to "overlay" current screen graphics with graphics that are stored on a diskette. To accomplish a simple overlay use the "OR" selection. To make special graphic effects using the Boolean operators, first save a copy of the screen graphic to disk. While the same graphic is on screen, enter the draw mode and use the <FCTN ARROW> keys to scroll the graphic several bit positions off center. After the graphic is offset, enter the VAULT and overlay the disk copy of your graphic using one of the Boolean operators.

Color is not allowed with these input functions. If a color screen is input with one of these functions, the color information will be ignored. If the screen (backdrop) color on the disk file is different from the backdrop color used by the drawing in the computer, the backdrop color on the disk will be used.

## COPROCESSOR

Perhaps the most difficult to learn section of BITMAC is the COPROCESSOR function. It requires additional equipment and user created software. However, the rewards for your effort are great! The COPROCESSOR function allows you to use a second computer to calculate plots for BITMAC. The other computer does not have to be a TI-99/4a. The only requirement for the type of computer you use is that it must have an RS232 interface and a cable that will interface it to RS232/2 of the TI-99/4a running BITMAC. For details on constructing the cable, please see the Texas Instruments RS232 manual or purchase a cable from a "third party" manufacturer.

Why would you want to link to a second computer? Dependant upon the software and the capabilities of computer 12, you can plot very elaborate and beautiful graphics, plot business graphs, analyze Landsat satellite data, construct maps, portray digital data from computer 12 and a wealth of other applications. The possibilities are almost endless. While the COPROCESSOR function is in operation, BITMAC can handle all the elaborate graphics while computer 12 concentrates on manipulating the data. In most cases the speed is limited by computer 12. As always BITMAC will be running in TMS9900 machine language at full speed.

The extended basic program "COWORKER" demonstrates one method of using the COPROCESSOR function. The program assumes that RS232/1 of computer 12 will be connected to RS232/2 of computer 11. The RS232 software specifications are:

```
BAUD RATE=9600
DATA BITS=8
PARITY=EVEN
```

For extended basic, the statement to open the file will be the same as the one included in the program "COWORKER".

The protocol for computer conversation is simple. BITMAC tries to send a character to computer 12 and waits until computer 12 receives it. When computer 12 receives the character, BITMAC knows that computer 12 will send a command next. Computer 12 then sends the command, BITMAC does the work and starts the process again by trying to send another character to computer 12. This process continues until computer 12 sends a command that tells BITMAC "I'm done you can go back to what you were doing".

For computer 12 to answer when BITMAC sends a character, you need to do an input: INPUT 11:IMREADY\$

The commands that computer 12 sends are all three characters long. The first character tells BITMAC what function you want, the second character gives BITMAC the Y coordinate (up and down 0 to 192), the third character gives BITMAC the X coordinate (left and right).

The allowable commands are:

```
"B" return control to <B>itmac
"L" <L>ine
"V" move <V>ector but don't draw
"P" place second <P>oint (like "clicking" the fire key)
"N" solid bits
"M" erase bits
"F" <F>lipbits (same as SWAPBITS)
"C" <C>lear screen
"S" <S>ave screen to memory
"O" restore <O>ld memory to screen
"0" (CHR$(0) not ASCII character 48),do last command again
"1" place <1> bit
```

The commands N,M,F,C,S and O do not require a Y or an X coordinate, however, you MUST send dummy characters where Y and X would ordinarily go. For example, to clear the screen you could send PRINT 11:"C";0;0 to draw a line you would need to specify Y and X like this: PRINT 11:"L",98,128 or PRINT 11:"L";Y;X.

The "do it again" command needs a little explanation. If you were to use PRINT 11:"0";Y;X your command would be ignored. The reason is that BITMAC expects PRINT 11:CHR\$(0);Y;X. The two are really different things! CHR\$(0) sends zero to BITMAC and "0" sends 48 to BITMAC (the ASCII value of the character "0" is 48). To have a command repeated, you can also send the same command over and over. However, using CHR\$(0) allows BITMAC to work much faster.

To avoid losing communications with BITMAC, remember you always input one character then output three. The last operation that computer 12 should do is output the "return to BITMAC" command:  
PRINT 11:"B",0,0

At some point while developing the program for computer 12, your program will stop while operating (all new programs do!) and you will lose communications with BITMAC. After this happens the "input one, output three" rhythm will be disturbed. To reestablish the rhythm you will need this sequence:

```
PRINT 11:"B",0,0
INPUT 11:OOPS$
PRINT 11:"B",0,0
```

This sequence will place BITMAC back in normal operation again. This "escape" sequence is also included at the beginning of the demonstration program "COWORKER". Depending upon where the program stopped, you may have to press CLEAR on computer 12.

To run "COWORKER", you will need to load the program with extended basic in computer 12. Start "COWORKER" running in computer 12 with the RUN command. At the prompt "SEND ESCAPE?" enter N for "NO". Load BITMAC in computer 11 in standard fashion and select COPROCESSOR from the VAULT texcons. The computers will establish communications and when "COWORKER" is finished computer 11 will return to BITMAC. Computer 12 will return to command mode.

The extended basic module is only required for the program "COWORKER". Your programs may be in the language of your choice. The only requirement is that your program uses the communications methods described here.

#### TEXT

By selecting the TEXT icon from the main icon set, text mode is available. Both upper and lower case are supported (insure the alpha lock is up on return to the icons). The arrow keys (E,D,X and S) are operational when used with the function key. If your text runs off the screen, it will "wrap" around the other side of the screen. If your text runs off the bottom of the screen, it will wrap around the top.

Text is considered to be the same as other graphics. The REDUCE, ENLARGE, ROTATE and all other function operate on text as well. In TEXT, the space bar leaves a 6 bit by 6 bit blank spot on the screen. The space bar is a good erase tool for graphics or text. If you use the left arrow key to back over your text, you may place text characters on top of one another.

The attached BITMAC screen dump shows the characters that are available. The <ENTER> key returns the computer to icon control.

## COLOR

To achieve the best results with color, it is recommended that you first complete your drawing devoid of color and save a copy to disk. After this is done, complete your drawing by painting in the colors.

The color icon ("checkered flag") is available from the main icon set. There are 16 colors available. When the color icon is activated, a palette of colors will appear at the top of the screen. To select a color, move the cursor to the desired color and Press the fire key.

Below the Palette four texcons are available: SCREEN, BACK, FORE and TEST. By moving the cursor to the screen texcon and pressing fire, your selected color will be assigned to the screen and the screen color (backdrop color) will change immediately.

By moving the cursor to the FORE texcon, your selected color will be assigned to the "on" bit color. The "on" bits are the bits you place on the screen, the "solid" bits. Immediately the color behind the FORE texcon will change to your selected color (the words SCREEN, BACK and FORE are always black) and the word "TEST" in the TEST texcon will change color. BY moving the cursor to the BACK texcon, your selected color will be assigned to the "off" bits. If you assign the same BACK and FORE color, bits in the drawing will become invisible.

The TEST texcon always reflects your current color selections. By activating this texcon a test pattern will appear on the screen. Colors may be tested until the desired combination is found. When you exit the color selection function, the last colors tried will be used when color is placed in the drawing. Until you activate the colors from LINE, CIRCLE, RECTANGLE or DRAW, there will be no immediate effect on your drawing.

In order to get full use of color, you should remember that bit "on" color, bit "off" color and screen color interact. For example, if you select red "on" color and white "off" color and Place next to this area red "'off" color and white "on" color they may appear the same. It you fill the first area with on bits and erase the second area, they will appear to be identical. This technique can be important in blending areas on the screen, however you will need to use SWAPBITS often to keep track of where the on and off bits are. Until you become familiar with BITMAC, it might be best to use only the FORE, SCREEN and TEST functions.

The print dump will not distinguish between colors, only between off bits and on bits. If your drawing uses BACK color, printer dumps may not truly reflect the screen image.

The Placement of color is done in a way similar to drawing bits on the screen. There are some differences however. Because of the way the TI-99/4A uses screen memory, less detail can be specified with color.

In bitmap mode (the screen mode that BITMAC uses) there are three "maps" the computer uses to determine what the screen looks like: SCREEN IMAGE, PATTERN DESCRIPTOR and COLOR.

The screen image "map" is set up when the program is started and is not changed throughout the program. It will not be discussed. Its function is mostly "administrative".

The PATTERN DESCRIPTOR map is the map that is changed when a new bit is Placed on the screen or an old bit is deleted. Most of the instructions so far have dealt with functions that work with this map.

The COLOR map is a different creature entirely. Consider it to be a second screen that sits behind the first screen (Pattern map). If two entries in these maps "line up" a visible image can be seen on the screen. Clear is a color on the TI-99/4A. You can place a bit in the pattern map, but if the color map says it is clear you won't be able to see it.

The placement of bits dealt with single points. A point was either on or off. In color a point can be RED, YELLOW, BLACK or one of the other 16 colors. However, when you say "point" to the color map you are talking about a point that is 8 bits wide.

These color "points" are unchangeable in their location. We can only tell the computer what color they will be. Your screen is 256 bits wide and 192 bits tall. Counting from the left side of the screen, starting at the top, the first color point describes bits 0 through 7. The next color point describes bits 8 through 15 and so on. That means that the first 8 bits in the upper left corner will all have to be the same color. The second set of eight bits will have to be the same color and so on.

There are no limitations on the way colors are placed up and down. However, you should plan how your colors are placed left and right on the screen. Any colors you place will fall into one of these 8 bit sets.

What does this mean to your drawing? If you want two bits, side by side, to be two different colors, they will both have to be in separate 8 bit color points or the colors will have to be specified in FORE color and BACK color.

If you want two bits, one above and one below, to be two different colors, no problem, because they will be in different 8 bit sets. By using SWAPBITS you can view the color map more efficiently and plan "on" and "off" bit colors.

=====  
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