DigiScan

Video Digitizer

USER MANUAL

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Video Digitizer

Designed and Manufactured in Australia by

Nickolas Marentes and David Meiklejohn

INTRODUCTION

A WORD FROM THE DESIGNERS

Congratulations on your purchase of the DigiScan Video Digitizer!

A low cost image processing system especially designed for the Tandy Color Computer 3. Every effort has been made during development to provide you with a reliable and useful computer accessory.

Over the last two years, countless hours have been spent in the hardware and software design that has finally become DigiScan. DigiScan is one of those products which 'evolved', starting from a small, simple and rather limited design to the final version we have now.

DigiScan has several advantages over previous digitizers for the Color Computer such as:

- Support of the computer's 320x200 16 colour and 640x200 4 colour graphics modes.

- No need for a Multi-Pak interface or Y-Cable. (DigiScan connects to the joystick and cassette ports)

- A very easy-to-use and professional looking software driver accessed by single keystroke commands.

- The capture and display of pseudo 4096 colour images created using a video camera and optional colour filters.

In order to achieve the maximum benefit from DigiScan, we strongly recommend that you read this manual thoroughly from start to end in order to understand the concepts behind image capture and presentation with DigiScan.

DigiScan is a tool used to expand one's creative abilities. It is a product which gets better as you discover new ways to use and apply it. Don't be discouraged if your first attempts are short of breathtaking. Time, patience and a creative desire to succeed is all that is needed to produce impressive images such as those found on the software driver disk supplied.

We hope you enjoy using DigiScan as much as we have in designing it. We are always keen to hear any feedback from users, both negative and positive so please write to us, maybe you could even send us some of your "masterpieces"! We'd certainly enjoy seeing what users are creating with their DigiScan units.

Nickolas Marentes

David Meiklejohn

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GETTING STARTED

EQUIPMENT REQUIRED

- A Tandy Color Computer 3 with 512K of memory, RGB or TV monitor and a disk drive.

- A video source such as a colour or black/white video camera or Video Cassette Recorder (VCR) with a good PAUSE function.

- Video leads to connect the video source to the DigiScan unit.

OPTIONAL EQUIPMENT

- Red, Green and Blue photographic colour filters for capturing the 4096 and 3-D images. (Camera needed)

- 3-D glasses for viewing the 3-D images.

MAKING A BACKUP COPY OF THE SOFTWARE DRIVER DISK

Never use the original disk when operating DigiScan. Ensure that a "write-protect" tab is placed on the write-protect notch of the original disk before proceeding any further. Format a new disk in drive 0 via the command "DSKINI 0".

If you have a single drive system, type "BACKUP" and press the <ENTER> key. Follow the prompts for when to exchange disks.

Double drive users, insert the original disk in drive 0 and the newly formatted disk in drive 1. Type "BACKUP 0 TO 1" and press the <ENTER> key.

When completed, store your original disk in a safe place and use only the backup copy.

BATTERY INSTALLATION

The DigiScan hardware is powered by a 9 volt ALKALINE battery (supplied). This battery should last for some time since it is only used while actually digitizing an image. The unit is automatically switched off at all other times. To replace the battery, carefully pull the two plastic halves that comprise the DigiScan case apart. Inside you will see the 9 volt battery attached via a clip. Remove it carefully from the clip and gently remove the terminal connector with the red and black wires.

Replace the new battery onto this connector, taking note that it can only attach one way without damaging the connector. After this, push the two halves of the DigiScan case together.

If you are not going to use DigiScan for a long period of time, remove the battery to prevent damage from the possibility of the battery leaking.

PRINTER SETUP

Before we start the DigiScan software, we must tell it what type of printer you have (needed for the PRINT function).

Because so many different printers and printer standards exist on the market today, it is difficult to write a printer driver for every possible printer. What we have done is to support the most common printer standards used by most Tandy Color Computer users.

Insert the backup copy of the DigiScan software into drive 0 and type RUN"SETPRINT" and press the <ENTER> key.

A list of printer drivers will be displayed. Depending on which printer you have or which printer standard your printer is compatible to, select the appropriate driver.

* See the section "Starting the DigiScan Software" also on this page with regards to printer baud rate selection.

CONNECTING THE DIGISCAN HARDWARE

(A) Place the DigiScan unit to the left of the Computer

(B) Plug each of the cables with the large 5-pin "DIN" plug into the corresponding jack on the back of the computer. Each lead has a small label to identify where it should connect.

(C) Connect the video output of the video source (VCR/Camera) to the DigiScan video input lead (with the RCA/Phono jack).

STARTING THE DIGISCAN SOFTWARE

Insert the DigiScan Software Driver disk into disk drive 0. Type RUN "DIGISCAN" and press the <ENTER> key. After a few moments you will see the Digiscan title page and soon after, the DigiScan control panel will appear.

A hidden function has been incorporated in this startup sequence which lets the user select the printer baud rate (computer to printer data transfer speed) for those who have printers capable of higher speeds. After typing RUN "DIGISCAN" as mentioned above, press and hold down the <ENTER> key till a menu screen appears. At this screen select the desired baud rate and press <ENTER> to continue loading the DigiScan software. Note that whenever the DigiScan software is started, it will always use the default baud rate that your computer starts up with (normally 600 baud for an unmodified Disk Basic).

KEYBOARD CONVENTIONS

The <BREAK> key is used universally as a means of terminating a function or returning to the control panel screen. All controls and commands are accessed by pressing a single key, usually the first letter of the function such as 'D' for DIGITIZE.

THE CONTROL PANEL

OVERVIEW

Once the DigiScan software is started, you will be presented with the main control panel screen. On this screen is where you alter a particular setting or select the function you wish to execute.

The alterable settings available are:

FILTER: Selects correct buffer and colour set for 4096 images.

MODE : Selects the image type to capture or display.

TEST : Displays SAMPLE and V-SYNC levels from the digitizer.

OFFSET: Allows the user to select the capture area.

BUFFER: Selects 1 of 8 image buffers.

The functions available are:

LOAD : Load an image from disk.

SAVE : Save an image to disk.

DIGITIZE: Capture an image from the video source.

WIPE : Erase an image stored in current image buffer.

COPY : Copy an image from the current buffer to another.

VIEW : View the image in the current image buffer.

EDIT : Edit the colour palette of the current image buffer.

RESET : Reset the colour palette of the current image buffer.

HERTZ : Select the screen update frequency.

PRINT : Print the current image buffer to the printer.

ANIMATE : Cycle through the buffers for animation of frames.

QUIT : Exit back to Disk Basic.

Along with these functions and settings, there is also a small display window (just under the DigiScan heading) where prompts and file selectors appear.

CONTROL PANEL SETTINGS

FILTER

By pressing the F key, the filter marker can be moved to select the desired filter setting.

Filter is used when digitizing images for display in the 4096 and 3-D modes (see 4096 and 3-D). By setting the filter setting to match the filter being used on the video camera lens, the digitized image will be displayed with the correct colour shade and stored in the correct image buffer for display as a 4096 or 3-D image. When digitizing with no colour filter on the camera lens or when digitizing from a video recorder, select the NONE setting.

MODE

Mode determines the display format. By pressing the M key, the mode marker can be moved to select the desired image mode setting.

16 "FALSE" COLOR - This is a 320x200 16 colour mode. It is a false colour mode because the Color Computer 3 does not have enough colours to represent the thousands of colours available in a photo realistic image. DigiScan simply treats all colours as 16 levels of brightness. Therefore, a default set of 16 colours is used to represent these 16 levels. These 16 colours can then be modified to any of the computer's 64 colours (see EDIT).

16 DITHERED GRAY - This mode uses the Color Computer's 640x200 high resolution mode. In this mode, the computer can only display 4 colours. In order to display the 16 gray levels, a technique called 'dithering' is used to create an apparent 16 shades. The trade off in using this method is that it makes the image look 'grainy'. There are two dither techniques available, ORDERED and RANDOM. Press the 'F1' key to toggle between the two dither techniques.

4096 "FLIKPIC" - This mode is basically three 16 level dithered images using red, green and blue shades (Buffers 1,2 and 3) instead of gray. These three colours are the primary colours by which all other colours are made from. These images can only be created using a video camera and red, green and blue optical filters. By digitizing these three images with their respective filters, the varying levels of the three primary colours is recorded. By displaying these images in quick succession, the colours can be made to mix, therefore creating up to a theoretical 4096 colours (16x16x16=4096). This mode produces the most photorealistic images, the trade off being a flickering effect.

3 DIMENSIONAL - This mode consists of two 16 level dithered gray images. These images are captured using a video camera. The first image is stored into the red buffer while the second image into the blue. The second image is captured with the camera about 20 centimeters to the right of the first but keeping the main subject matter at the same position on the screen. When these images are displayed, the red and blue images are displayed rapidly in succession. The image is then viewed with a set of 3-D glasses and the 3-Dimensional effect can be seen.

TEST

This allows you to adjust the DigiScan "sample" level in reference to the signals coming in from the DigiScan hardware.

Firstly, make sure you have a video signal entering the DigiScan hardware.

Press T to activate the test. A dotted horizontal line representing the "sample" level will be drawn and two vertical bars labeled SAMPLE and V-SYNC will be plotted. The ideal setting is to have the horizontal dotted line about 2 millimetres below the peak of the shortest bar. To adjust this sample line, press the PLUS (+) key to raise it or the MINUS (-) key to lower it. In most cases the default setting will be the ideal and you should only need to adjust it if you find any erratic behaviour during digitizing.

OFFSET

The actual image area that DigiScan captures is slightly smaller than the incoming image. Using the 4 arrow key, you can adjust which part of the complete image you wish to capture. The white box indicates the captured area whereas the entire area within the frame indicates the complete image area.

BUFFER

By pressing the B key, the buffer marker can be moved to select the desired image buffer to use. Most functions use the currently selected buffer.

CONTROL PANEL FUNCTIONS

LOAD

Press L at the control panel screen to select the LOAD function. The prompt SELECT DRIVE: will appear.

Press the drive number (1-4) that contains the disk containing the image you wish to load. The drive will start and all the image files will be listed.

The small display window will only display 3 files at a time and you must press the up and down arrow keys to view any others. You will notice in the display window a small arrow pointing to the right at one of the filenames. Move the desired file next to this arrow and press the <ENTER> key to load it into the current buffer.

SAVE

Press S at the control panel screen to select the SAVE function. The prompt SELECT DRIVE: will appear.

Press the drive number (1-4) that contains the disk onto which you wish to save the image to. Another prompt ENTER FILENAME: will appear.

Type in an 8 character filename using letters, numbers and space.

Press the <ENTER> key and the image in the current image buffer will be saved to the selected disk.

If there is not enough space on the disk or the disk is faulty, an error will occur. The computer will warn you and return you to the control panel. Get another formatted disk and try again.

DIGITIZE

Press D at the control panel screen to select the DIGITIZE function. Be sure to have a video signal entering the Digiscan hardware otherwise the software will simply sit there and wait for a signal. Press <BREAK> to exit back to the control panel.

With a video signal entering the DigiScan hardware, a vertical line will sweep from right to left. As it sweeps across the screen, it creates a digitized image of the incoming video signal.

WIPE

Press W at the control panel to select the WIPE function. The prompt ARE YOU SURE? will appear.

If you press Y (Yes) the image in the current image buffer will be erased. If you press N (No) then the image will be left intact and the wipe function will be deselected.

Ensure that you have selected the correct image buffer before you select Yes.

COPY

Firstly, select the image buffer that you wish to copy FROM using the B key.

Press C to select the COPY function. The prompt COPY TO WHICH BUFFER? will appear.

Press the number of the image buffer (1-8) that you wish to copy TO.

The contents of the current buffer will be copied to the selected buffer including it's colour palette.

VIEW

Press V at the control panel to select the VIEW function.

The image in the current buffer will be displayed. In the case of the 4096 and 3D images (see MODE, 4096 and 3D), image buffers 1,2 and 3 are cycled rapidly to produced the desired display.

Press the <BREAK> key to exit back to the control panel.

EDIT

* This function will not work if MODE is set to 4096 or 3D.

Press E at the control panel to select the EDIT function. The current image buffer will be displayed and all occurrences of colour 0 will flash.

You are now in the "Colour Select Mode".

Pressing the <BREAK> key at this stage will return you to the control panel. Use the up and down arrow keys to select a colour to modify and press the <ENTER> key.

You are now in the "Select New Colour Mode".

The screen border will change to match the selected colour. You can cycle through the computers's palette of 64 colours using again, the up and down arrow keys. The selected colour will be updated immediately so that you can determine which colour is most suitable.

If you wish to restore the original colour and return to the "Colour Select Mode", press the <BREAK> key.

Once you are satisfied that you have found a suitable colour, press the <ENTER> key to make the change permanent and return to the "Colour Select Mode".

RESET

* This function will not work if MODE is set to 4096 or 3D.

Press R at the control panel to select the RESET function.

The colour palette of the current image buffer will be reset to a default set depending on the MODE and FILTER settings. (see table)

MODE	FILTER	NEW PALETTE	BUFFER
16 COLOR	RED	Default 16 colour	1
16 COLOR	GREEN	Default 16 colour	2
16 COLOR	BLUE	Default 16 colour	3
16 COLOR	NONE	Default 16 colour	Current
16 GRAY	RED	Red shade	1
16 GRAY	GREEN	Green shade	2
16 GRAY	BLUE	Blue shade	3
16 GRAY	NONE	Gray shade	Current

HERTZ

Press H at the control panel to select the HERTZ function. This will toggle the screen update frequency between 50 and 60 cycles per second. 50 is the standard for Australian/European TV's and monitors. 60 is the standard for the USA.

The advantage of switching to the higher (60) screen update is for displaying the 4096 and 3D images. The faster update helps reduce the flickering effect seen in these display modes (see 4096).

Please note that some monitors may 'roll' the image when this setting is changed. This can be corrected if your TV/monitor has a vertical adjust control. If not, we suggest that you stick to the default setting.

PRINT

* Be sure to select the correct printer driver before attempting a printout (See PRINTER SETUP).

Press P at the control panel to select the PRINT function.

The prompt NORMAL OR INVERTED PRINTOUT? will appear. Normal will print the image with the same "polarity" as on the screen. For example, blacks on the screen will be black on the printout. With Inverted, it is reversed. Press N or I to continue.

Another prompt SET PRINTER AND PRESS ENTER will appear. This gives you a chance to prepare your printer, making sure that the paper is aligned and that it is online and ready to print. Press <ENTER> to begin printing the image in the currently selected image buffer.

If you wish to abort a printout, press and hold the <BREAK> key till you are returned to the control panel.

The printout may take awhile to complete. Exactly how long depends on the baud rate (data speed) and printer speed.

ANIMATE

Animate allows you to view a series of buffers quickly therefore giving the effect of movement. The images stored in the buffer normally would be captured from a video tape a frame at a time using the PAUSE function of the VCR.

Firstly select the image buffer to start the animation FROM using the B key.

Press A at the control panel to select the ANIMATE function. The prompt ANIMATE TO WHICH BUFFER? will appear.

Select the image buffer at which the animation will end by pressing a number key (1-8).

Another prompt, BOUNCE OR LOOP? will appear. Bounce means that the animation will be played continuously from Start-to-End then End-to-Start. Loop means that it will be played continuously from Start-to-End only.

Press B or L and the animation will start.

Note that to save an animation, you must save each image individually. The same holds true for loading. A good idea is to label each image in such a way that you know which buffer each image is to load into (PICTURE1, PICTURE2, PICTURE3 etc.).

QUIT

Quit simply exits the DigiScan Software and returns to Disk Basic.

Press Q at the control panel to select the QUIT function. The prompt ARE YOU SURE? will appear. Press Y for yes, N for No.

When an exit back to Disk Basic is made, all images stored in the eight image buffers are left intact. This allows you to restart the DigiScan Software and continue working with the original images, assuming you haven't powered down the computer or run anything else that may erase the image buffers. If any of the images had a custom palette originally, that palette can also be restored by selecting the desired image buffer and pressing the 'F2' key.

IMAGE CAPTURE

PREPARING AN IMAGE

If you are using a VCR, simply locate a suitable image and press the PAUSE button. Some VCR's have a very poor frame pause resulting in a jumping or "torn" picture. The best pauses are achieved when using a tape that has been recorded on the same VCR (eg. TV shows)

If you have a camera, everything is much easier since you can keep the camera pointing at a static object as long as you wish.

Don't try digitizing images which have too much detail. 16 levels of gray is not enough to bring out all of the subtle details in a complex image. Also, as in film photography, lighting is one of the most important factors in obtaining quality images. If using a VCR, choose a well lit scene. If using a camera, light the subject using photo flood lights or sunlight. Ensure even lighting on the subject. Don't choose subjects which are well lit on one side but fall into shadow on the other unless you are deliberately trying for a dramatic effect. Also avoid scenes which have a bright subject matter on a bright background or dark subject matter on a dark background.

CAPTURING A 16 LEVEL IMAGE

Select the desired video MODE using the M key.

Set FILTER to the appropriate setting. If you wish to capture a 16 level colour or 16 level gray image, set it to NONE. If you wish to capture a 4096 or 3D image, refer to the next 3 chapters.

Feed a suitable video signal into the DigiScan hardware and select the DIGITIZE function. A vertical line will sweep from right to left. As it sweeps across the screen, it creates a digitized image of the incoming video signal.

You can now adjust the brightness and darkness levels of the image by turning the dials on the DigiScan hardware. The black dial adjusts the image black level. Turning it anti-clockwise reduces the amount of black. Turning it clockwise increases the amount of black. The white dial functions the same way for the white level.

Your aim is to adjust each level so that there is a minimal amount of extreme black and extreme white. After this, you may 'fine tune' the image by adding more black to sharpen the contrast or add more white to brighten the image. The actual capture area is slightly smaller than the actual incoming video image area. By adjusting the OFFSET setting (See OFFSET), you can move the capture area within the total image area.

You can alter the dithering pattern (ordered or random) used during capture by pressing the F1 key. The ordered pattern seems best for gray images whereas random is best for the 16 colour images.

When you are satisfied with the captured image, press and hold the <BREAK> key next time the sweeping line disappears to the left of the screen.

4096 COLOUR IMAGES

The Color Computer 3 can only display 16 solid colours on the screen at one time. These 16 colours are selectable from a palette of 64 colours. A video image as seen from a colour video camera or VCR can contain thousands of colours. It is impossible to display these images on the Color Computer 3 display without sacrificing much of the original colour detail. With DigiScan, a method of displaying more than 16 colours has been included which is capable of creating up to 4096 perceived colours. Unfortunately, a sacrifice needs to be made in order to achieve such results.

A 4096 image is actually composed of three different 16 level dithered gray images. The difference between each of these images is that each represents one of the three primary colours of red, green and blue. By rapidly displaying each of these images in succession with their correct red, green and blue colour hues, 4096 perceived colours will be seen.

Now we come to the sacrifice. An image displayed on a video screen is updated 50 times a second (60 in the USA). At this rate, we see the image with virtually no flickering. When displaying 4096 images, three images are required to produce the one perceived image, therefore the image update becomes 16 (20 in the USA) times a second. At this rate, flickering is quite apparent, especially with brightly lit images. There is no way to increase this update time since this is a fixed rate forced on by the video display standard. If the three images are flashed any faster, the images will look broken up and the colours incorrect.

CAPTURING 4096 COLOUR IMAGES

To capture a 4096 colour image, it is necessary to split the red, green and blue components of the source image. A simple and inexpensive method is with the placement of red, green and blue colour filters in front of the lens system of a standard video camera. The success of this system will vary from camera to camera. Generally, best results are obtained using a monochrome security type camera but the popular home video camera setup will also work. One problem with most video camera systems is that they incorporate an automatic iris or light level control. This plays havoc with the final colour balance of the captured image and occurs because each colour filter will vary the amount of light entering the lens. The camera sensing this will adjust the brightness of the image automatically to keep the image at an even light level. Unfortunately, there is little we can do about this.

There are basically two types of colour filters available. The first is the professional glass photographic type. These are expensive but will yield the best results. The other is the less expensive coloured perspex type. These work satisfactory as long as the correct colours are used. Plastic filters have a tendency to blur the image. Be sure to correct the camera focus for each colour filter used, making sure not to move the camera in the process.

Armed with a reasonable video camera and a set of colour filters, you are ready to begin capturing some images. Firstly, ensure that the subject matter you wish to digitize is well lit. Avoid excessive shadowing.

Set the MODE setting to 4096 and the FILTER to red.

Place the red colour filter in front of the camera lens (Blu-Tak is useful here!) being careful not to move it.

Select DIGITIZE and capture the image, adjusting the black and white level controls as described earlier.

When satisfied, press and hold the <BREAK> key to return to the control panel.

Without moving the camera, changing the light levels or changing the DigiScan level controls, repeat this process using the green filter setting and green colour filter and again for the blue. When all is done, you will have three separate images in buffers 1, 2 and 3 which represent the RGB light levels of the subject.

You may now VIEW the combination of these images.

If you don't have a good source of light or find it inconvenient to constantly setup cameras and filters next to your computer, you may be interested in the following tips. It may be easier to video tape the three filtered images outdoors using sunlight to illuminate the subject. Later, at your convenience, digitize off tape each of the three images.

CAPTURING 3-DIMENSIONAL IMAGES

3-D images consist of two images captured at slightly different angles from each other. Filters are not needed for 3-D images but each image must be placed into its corresponding red and blue (buffer 1 and 3) image buffer and viewed with a set of 3-D glasses as used in many of the old 3-D movies.

After preparing a suitable subject and setting the correct lighting, capture an image into buffer 1.

Next, move the camera about 20cm to the right and capture another image into buffer 3. Make sure you keep the subject matter centred in both cases.

Once captured, you may VIEW your efforts with your glasses.

Note, we are assuming that the 3-D glasses you will be using have the red lens on the left and the blue on the right. If they are the opposite then you must place the left captured image into the buffer 3 and the right captured image into buffer 1.

IMG FILES

IMG FILE FORMAT

The first byte of the file is a dummy byte reserved for future use.

The second byte contains the video MODE information.

BYTE VALUE	DISPLAY MODE	RESOLUTION
1	16 "False" Colour	320x200
2	16 Dithered Gray	640x200
3	4096 "FlikPic"	3x(640x200)
4	3 Dimensional	2x(640x200)

The next 16 bytes contain the 16 palette values used for the 16 colour and 16 dithered gray images. 4096 and 3D images ignore these 16 palette values although they still exist in the file structure.

From here on, the file is allocated in ALTERNATING blocks of compressed and uncompressed data, the first being uncompressed. An uncompressed block starts with a byte indicating the number of uncompressed bytes that follow (255 Max) then that number of bytes. A compressed block starts with a byte indicating how many times the next byte is to be repeated. If any of these two blocks start with two bytes of 00, then this indicates the end of image data. If it ends with only one byte of 00, then it indicates a null block.

The following example data...

```
 05 23 F4 08 7A 2B     03 20       00      08 04      00 00
[-----------------] [----------] [----] [---------] [-------]
    Uncompressed     Compressed    Null   Compressed    End
```

Would uncompress to...

```
23 F4 08 7A 2B 20 20 20 04 04 04 04 04 04 04 04
```

In the case of the 4096 colour images, 3 separate RGB images are contained within one file. The software knows that after receiving the first 00 00 end-of-image marker, that it is followed by another image destined for buffer 2 (green) and again for buffer 3 (red).

The same goes for the 3D images except that there are two buffers, destined for buffers 1 and 3.

IMG TO COCOMAX3 IMAGE CONVERSION

On the CoCoMax3 distribution disk is a file called TRANSLAT which is used for converting hi-res graphic images from various formats to CoCoMax 3 format. Using this program makes the conversion of images stored in the standard HSCREEN 2 graphics area to CoCoMax format very easy. Unfortunately, a problem arises in that the original palette used in the image is lost since TRANSLAT uses its own default palette and so the image is incorrectly coloured.

To correct this for DigiScan images, load the TRANSLAT program into memory and modify the following line in the BASIC listing to:

```
1310  FOR A=0 TO 15:PALETTE A,LPEEK(&H67FF0+A):NEXT
```

Save this modified version of TRANSLAT to your DigiScan software disk (not the original!).

From now on, when you wish to convert a DigiScan image to CoCoMax3, start the DigiScan software and load the desired image into image buffer 1. Exit the DigiScan software via the QUIT function and RUN the modified TRANSLAT program. Follow the prompts as described in the CoCoMax 3 manual to save the image from RAM.

IMG TO COLORMAX3 IMAGE CONVERSION

As in the previous chapter, the palette needs to be restored prior to saving the image from memory. Use the utility program called BSCTOOL which was sold by the people who created ColorMax 3.

Load BSCTOOL into memory as per its operation manual then key in the following lines of BASIC code:

```
10 FOR A=0 TO 15:PALETTE A,LPEEK(&H67FF0+A):NEXT
20 EXEC:R:S:"filename.MGE"
```

Substitute your own filename in line 20. Prepare a disk in drive 0 and RUN the program.

TECHNICAL DETAILS

HARDWARE SIGNALS

The following table lists all of the control signals sent from the DigiScan hardware to the computer. No signals are sent from the computer to the DigiScan hardware.

SIGNAL	PORT	PIN NUMBER	DESCRIPTION
VSYNC	Right Joy	1 (Left/Right)	Signals top of frame
SAMPLE	Left Joy	2 (Up/Down)	Signals pixel data ready
DATA-0	Right Joy	4 (Button 1)	Video data bit 0
DATA-1	Left Joy	4 (Button 1)	Video data bit 1
DATA-2	Right Joy	6 (Button 2)	Video data bit 2
DATA-3	Left Joy	6 (Button 2)	Video data bit 3
GROUND	Right Joy	3 (Ground)	Signal Ground
SWITCHA	Cassette	1 (Remote)	Power switch terminal 1
SWITCHB	Cassette	3 (Remote)	Power switch terminal 2

DIGITIZING SOFTWARE ROUTINE

On the following pages is the assembly language listing of the portion of code that actually captures and displays the video information entering the DigiScan hardware. It has been provided for anyone interested in developing their own software drivers under RS-DOS or OS-9 or wish to study the dithering techniques used for the 16 dithered gray mode.


```
00001 * Routine Name: DIGITZ
00002 * Description : Digitize and process video signal
00003
00004 DIGITZ  LDA    MODE    Select processing mode
00005         LDX    #NOCONV (No Conversion)
00006         CMPA   #1
00007         BEQ    GRA
00008         LDX    #CONV16 (16 gray conversion)
00009 GRA     STX    CONV
00010
00011         * Activate Digitiser Hardware
00012
00013 RESET   LDA    $FF21   Cassette relay ON
00014         ORA    #8
00015         STA    $FF21
00016         LDB    #25     Delay for digitizor power up
00017         JSR    DELAY
00018
00019         * Offset from Right Edge
00020
00021         LDA    #$34    MUX Select:Right-X (V-SYNC)
00022         STA    $FF03
00023         STA    $FF01
00024
00025         LDA    #7
00026         SUBA   XOFSET
00027         LDB    #1
00028 WHE     CMPA   #0
00029         BEQ    ROFF1
00030         ADDB   #24
00031         DECA
00032         JMP    WHE
00033 ROFF1   JSR    ABORT   Wait for LO
00034         LDA    $FF00
00035         BMI    ROFF1
00036 ROFF2   JSR    ABORT   Wait for HI
00037         LDA    $FF00
00038         BPL    ROFF2
00039         DECB
00040         BNE    ROFF1
00041
00042         LDA    #$3C    MUX Select:Left-Y (SAMPLE)
00043         STA    $FF03
00044         STA    $FF01
00045
00046         * Capture Video frame
00047
00048         LDU    #$809F  Set 1st Column
00049
00050 GRAB    STU    COLUMN
00051         LDB    #201    Set # of Vertical Pixels
00052         JSR    VSYNC   Wait for top of image
00053 PIXEL1  LDA    $FF00   Wait for SAMPLE HIGH
00054         BPL    PIXEL1
00055 PX1B    LDA    $FF00   Wait for SAMPLE LOW & Load Data
00056         BMI    PX1B
00057         ANDA   #15     Mask out unwanted bits 4-7
00058         JSR    [CONV]  Call Conversion routine
00059         ANDA   #15     Mask out left two pixels
00060         STA    ,U      Store pixel on screen
00061         LEAU   160,U   Move to next pixel down
00062         DECB
00063         BNE    PIXEL1  Loop for full column
00064
00065         LDU    COLUMN  Get top of column again
00066         LDB    #201    Set # of Vertical Pixels
00067         JSR    VSYNC   Wait for Top of Image
00068 PIXEL2  LDA    $FF00   Wait for SAMPLE HIGH
00069         BPL    PIXEL2
00070 PX2B    LDA    $FF00   Wait for SAMPLE LO & Load Data
00071         BMI    PX2B
00072         ANDA   #15     Mask out unwanted bits 4-7
00073         JSR    [CONV]  Call Conversion routine
00074         ANDA   #240    Mask out right two pixels
00075         ORA    ,U      Merge pixel onto screen
00076         STA    ,U
00077         LEAU   160,U
00078         DECB
00079         BNE    PIXEL2  Loop for full column
00080         JSR    ABORT   Check for <BREAK> abort
00081
00082         LDU    COLUMN  Get top of column again
00083         LEAU   -1,U    Shift column left 1 byte
00084         CMPU   #$7FFF  Check for last column
00085         LBHI   GRAB    No, Go back for another column
00086         LDA    $FF21   Cassette relay OFF
00087         ANDA   #247
00088         STA    $FF21
00089         LDB    #50     Delay for hardware power off
00090         JSR    DELAY
00091         JSR    ABORT
00092         JMP    RESET   Go back for another frame
00093
00094
00095         * Sync to V-SYNC subroutine
00096
00097 VSYNC   LDA    #$34    MUX Select:Right-X (VSYNC)
00098         STA    $FF03
00099         STA    $FF01
00100         STB    TEMP1   Save column counter value
00101
00102 FIELD1  LDA    $FF00   Wait for LO
00103         BMI    FIELD1
00104 F1      LDA    $FF00   Wait for HI
00105         BPL    F1
00106 FIELD2  LDA    $FF00   Wait for LO
00107         BMI    FIELD2
00108 F2      LDA    $FF00   Wait for HI
00109         BPL    F2
00110
00111         LDB    #$3C    MUX Select:Left-Y (SAMPLE)
00112         STB    $FF01
00113         STB    $FF03
00114
```

```
00115           LDB     YOFSET  Time delay offset from top
00116           INCB
00117 VSB       LDX     #35
00118 VSC       LEAX    -1,X
00119           CMPX    #0
00120           BNE     VSC
00121           DECB
00122           BNE     VSB
00123
00124           LDA     #118    (F2) Fine adjust
00125           STA     $FF02
00126           LDA     $FF00
00127           ORA     #128
00128           CMPA    #191
00129           BNE     VSC2
00130           LDA     VFINE
00131           ADDA    #10
00132           STA     VFINE
00133 VSC2      LDA     VFINE
00134 VSC3      DECA
00135           BNE     VSC3
00136           LDB     TEMP1
00137           RTS
00138
00139           * Convert to 16 Dither subroutine
00140
00141 CONV16    STB     $0000   On Entry: A = 16 Level DATA
00142           ANDB    #3
00143           LSLA
00144           LSLA
00145           STA     $0001
00146           ORB     $0001
00147           CLRA
00148           ADDD    #TBL16G
00149           TFR     D,X
00150           LDB     $0000
00151           LDA     ,X
00152           RTS
00153
00154 NOCONV    STA     $0000   16 color data conversion
00155           LSLA
00156           LSLA
00157           LSLA
00158           LSLA
00159           ORA     $0000
00160           RTS
00161
00162 TBL16G    FDB     $0000   16Gray dither conversion table
00163           FDB     $0000
00164           FDB     $5005
00165           FDB     $5005
00166           FDB     $5555
00167           FDB     $5555
00168           FDB     $5955
00169           FDB     $5555
00170           FDB     $5995
00171           FDB     $5995
00172           FDB     $9669
00173           FDB     $9669
00174           FDB     $A99A
00175           FDB     $A99A
00176           FDB     $9AAA
00177           FDB     $A9AA
00178           FDB     $AAAA
00179           FDB     $AAAA
00180           FDB     $BAAA
00181           FDB     $ABAA
00182           FDB     $ABEA
00183           FDB     $AEBA
00184           FDB     $AFFA
00185           FDB     $AFFA
00186           FDB     $BBEE
00187           FDB     $BBEE
00188           FDB     $BFFB
00189           FDB     $BFFB
00190           FDB     $EFFF
00191           FDB     $FEFF
00192           FDB     $FFFF
00193           FDB     $FFFF
00194
00195           * Key Abort Check subroutine
00196
00197 ABORT     LDA     #251
00198           STA     $FF02
00199           LDA     $FF00
00200           ORA     #191
00201           CMPA    #191
00202           BNE     NOCONV
00203           LDA     $FF21   Cassette relay OFF
00204           ANDA    #247
00205           STA     $FF21
00206           LDB     #25     Delay for digitizor power off
00207           JSR     DELAY
00208           JMP     EXIT
00209
00210           * Time delay subroutine
00211
00212 DELAY     TST     $FF02
00213 VWAIT     TST     $FF03
00214           BPL     VWAIT
00215           DECB
00216           BNE     DELAY
00217           RTS
00218
00219           * Variables
00220
00221 CONV      FDB     0
00222 COLUMN    FDB     0
00223 MODE      FCB     2
00224 XOFSET    FCB     10
00225 YOFSET    FCB     10
00226 TEMP1     FCB     0
00227 VFINE     FCB     1
```



```
100 '-------------------------------------------------------------------------
110 '              DIGI-SCAN VIDEO DIGITIZER: Driver Boot Progr
120 '
130 '                    Copyright 1991 by Nickolas Marentes
140 '-------------------------------------------------------------------------
150 '
160 WIDTH 32:PCLEAR1:CLEAR100,&H3FFF:RGB:PALETTE12,63:PALETTE13,8
170 '
180 '------ Select Printer Baud Rate ------
190 '
200 IF PEEK(&H152)<>191 THEN 280
210 CLS:PRINT:PRINT"      SET PRINTER BAUD RATE":PRINT:PRINT STRING$(32,128);
220 PRINT:PRINT:B=600:FORT=1TO5:PRINTTAB(11);T;CHR$(8)":"B:B=B*2:NEXT T:PRINT
230 PRINT@421,"ENTER SELECTION 1-5";:INPUT B
240 IF B<1 OR B>5 THEN 210
250 IF B=1 THEN B=87 ELSE IF B=2 THEN B=41 ELSE IF B=3 THEN B=18
260 IF B=4 THEN B=07 ELSE IF B=5 THEN B=01
270 POKE 150,B
280 PALETTE13,0:CLS:PRINT"LOADING..."
290 '
300 '------ Load Title Page Graphics ------
310 '
320 POKE &HFFA2,12:POKE &HFFA3,13:LOADM"TITLE/GX1"
330 POKE &HFFA2,14:POKE &HFFA3,15:LOADM"TITLE/GX2"
340 '
350 '--------- Display Title Page ---------
360 '
370 POKE &HE6C6,18:POKE &HE6C7,18
380 FOR P=0 TO 15:READ C:PALETTE P,C:NEXT:HSCREEN 2
390 POKE &HFF9D,48:POKE &HFF9E,00
400 '
410 '----- Load Control Panel Graphics ----
420 '
430 POKE &HFFA2,16:POKE &HFFA3,17:LOADM"PANEL/GX1"
440 POKE &HFFA2,18:POKE &HFFA3,19:LOADM"PANEL/GX2"
450 '
460 '--------- Load Sound Effects ---------
470 '
480 POKE &HFFA2,00:LOADM"SOUND/BIN"
490 '
500 '--------- Restore MMU Blocks ---------
510 '
520 POKE &HFFA2,58:POKE &HFFA3,59:CLEAR 100,32700:PCLEAR 8
530 '
540 '--------- Load Character Set ---------
550 '
560 LOADM"CHR~ET.BIN"
570 '
580 '--------- Load Printer Driver --------
590 '
600 LOADM"PRINTER.DRV"
610 '
620 '-------- Load DigiScan Program -------
630 '
640 LOADM"DIGISCAN.BIN"
650 '
660 POKE &HFF40,0:EXEC
670 DATA 00,00,00,56,63,01,08,09,00,00,00,00,00,18,00,52
```

MISCELLANEOUS NOTES

JAGGERS

Since the quality of video signals can vary from device to device, you may occasionally see a vertical band where the image is "jagged". If you notice this "jagged" column, you may be able to remove them by adjusting the vertical offset (up and down arrow keys) from the control panel. This should shift the jaggers off screen so that they cannot be seen.

IMAGE CAPTURE LIMITATIONS

SPEED: A standard video image is constantly updated 50 (60 in the USA) times a second. This rate is too fast for the Color Computer 3 to decode in "real time", therefore a system of multiple scanning is used. It takes approximately 15 seconds for DigiScan to completely scan and compile an image into 16 levels. This means that the image being captured must remain stationary for this time in order to avoid blur and multi-imaging.

COLOUR: Rascan ignores the colour information within a video signal. The extra circuitry required to decode the complex colour information would have increased the production costs and therefore the final retail price to the consumer. Also, the Color Computer 3 does not have an adequate colour palette to reproduce the range of colours available in most video images.

RESOLUTION: DigiScan internally converts video data into 256 levels of gray (8-bits). Since DigiScan connects to the joystick ports and transfers the video data via the four joystick buttons, this reduces the number of gray levels to 16 (4 bits).

DISCLAIMER

The DigiScan software carries a ONE year guarantee from date of purchase. This guarantee does not apply to any DigiScan unit damaged as a result of abuse or tampering. The designer/manufacturer or distributor shall not be liable for any damages or loss of information that may result from the use of this package.

The DigiScan software is provided as-is without warranty. Software updates will be made available to DigiScan users for a small fee to cover postage, media costs and other expenses. If the user finds errors in the software or wishes to offer possible tips for enhancement, then he/she should contact their distributor.

SAMPLE PICTURES

On the flip side of the DigiScan Software Driver disk are several sample images captured using DigiScan. None of the images have been enhanced or modified and are raw digitized images showing what can be achieved with the package.

R2D2, SINGER and VADER are 16 level dithered gray images captured off video tape using a 2-head VCR. All three images use the ordered dithering technique.

ARNOLD is a 16 colour image captured off video tape. It uses the random dither technique and default 16 colour palette.

FACE4096 is an example of the flickering 4096 colour mode. This image was captured using a video camera and filters. To help minimise the amount of flicker, try switching to the 60 Hertz setting. Note that some TV/monitors may roll the picture. If this happens, it can be corrected using the vertical hold adjust if your TV/monitor has one.

LOGO1 to LOGO8 are eight simple images which all must be loaded into thier respective buffer assignments (eg. LOGO1 into buffer1). Next, highlight buffer 1 and select the ANIMATE function. Press '8' followed by 'B'. You will see the word DIGISCAN 'type' up onto the screen. This is a very simple example of the animate function. These images where created using a video camera and digitizing each image in turn, adding in an extra letter onto the page using a black marker.