THE MICRO WORKS

DIGISECTOR
DS-69 / 69B

OWNER'S MANUAL

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DS-69 OWNER'S MANUAL

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The Micro Works gratefully acknowledges the contributions of Mr. Tim Jenison to both the software and hardware design of the DS-69.

INTRODUCTION

First, thank you for buying a Micro Works DS-69 Digisector. Every effort has been made in the development of the DS-69 and its software to provide you with a long lasting and reliable computer accessory. We suggest that you read this manual thoroughly before installing the DS-69. Differences in operation between the various models of the DS-69 Digisector are noted in the text.

The Micro Works DS-69 is a video digitizer which accepts a NTSC standard video input from a source such as a closed circuit television camera or video tape recorder and converts the analog video signal to digital data, a form which is usable by your Color Computer.

Printer drivers are supplied for several different printers. Drivers are included for the Epson, Radio Shack, C.ITOH, NEC, Hewlett Packard, and Okidata printers and their respective compatibles. We are constantly trying to update this list. If your printer is not currently supported, contact us. We may have a new printer driver that will work.

REQUIRED AND OPTIONAL HARDWARE

Disk Systems:

1. Radio Shack Color Computer with 64K RAM
2. At least one disk drive; two is recommended
3. Black and White Camera or other video source, color cameras with the DS-69B.
4. Radio Shack Multipak Interface or PBJ C-C Bus
5. Graphics printer (optional)
6. Joysticks (optional)
7. Black and White monitor (optional)

Cassette Systems:

1. Radio Shack Color Computer with 64K RAM
2. Cassette recorder
3. Black and White Camera or other video source, color cameras with the DS-69B. .
4. Graphics printer (optional)
5. Joysticks (optional)
6. Black and White monitor (optional)

UNPACKING

When you receive your DS-69, remove it from the package carefully and inspect it for damage that may have occurred during shipping. If it appears damaged, save all packing material and notify the carrier immediately.

The DS-69 contains MOS integrated circuitry which may be damaged by static electricity. Do not touch the exposed edge connector and NEVER PLUG THE DS-69 INTO OR REMOVE IT FROM A SYSTEM WITH THE POWER ON. This is dangerous to both your Color Computer and the DS-69.

CAMERAS

The DS-69B will work with either a color or black and white camera. The DS-69 requires a black and white camera for best results. If you use the DS-69 with a color camera the color information from a brightly colored scene may cause interference with the digitizing process and vertical bars will appear in the digitized image.

We have found that proper lighting is one of the most important factors in obtaining quality images. Use the DS-69 with sufficient light, preferably photo floodlights or sunlight on the subject. Pictures can be taken in room light but it may be hard to obtain high picture quality. A zoom lens will give you additional versatility in selecting focal points.

WARNING: Never point a video camera directly at a bright light source as this may permanently damage the vidicon tube.

VIDEO CASSETTE RECORDERS

You may use a VCR as a video source, however the Digisector's picture quality depends greatly on the VCR and cassette used. Digitize the picture while the VCR is in the freeze frame mode. This ensures that the DS-69 has enough time to digitize the entire picture without blurring. The DS-69B is fast enough to digitize an image from a VCR while in the play mode, as long as nothing in the picture is moving too fast.

The picture on the television must be quite good to obtain good results. A noisy picture with snow, horizontal tearing, or vertical jitter will result in an unrecognizable image. What you see is what you get.

We have found that the best results are obtained using a 4-head VCR of reasonable quality. While some of the 2-head systems will work, they generally have extremely noisy freeze frame pictures.

MONITOR HOOKUP

We suggest the use of an optional monitor for focusing and composing pictures. While this is not required, it will permit you to see the camera's output as well as the digitized picture.

If you wish to use a video monitor with your Digisector it must be of the non-terminated type. Some monitors have a switch located on the back to select terminated/non-terminated operation. The DS-69 is terminated (has a 75 ohm resistor between the signal line and ground). Adding a terminated monitor to the input line reduces the signal strength to the DS-69 and the Digisector will not function properly.

In addition to a non-terminated monitor, you may need a tee connector for your video cable and one or two additional cables. Seventy-five ohm coaxial cable is best for video connections, but ordinary shielded audio cable will usually work fine. Cable length should be less than six feet total to minimize noise. Cables and connectors can be purchased at your local Radio Shack or video store.

Refer to Figure 1:

Connect one cable from your camera (or other video source) (a), to the tee connector (b).

Connect another cable from the tee (b) to the DS-69. (This cable will plug into the jack on the ROMPACK)

Connect the third cable from the tee (b) to your monitor (d). This cable should be as short as possible.

Some monitors have a loop-thru connection that can be used instead of the tee. In this case refer to Figure 2.

Connect one cable from your camera (or other video source) (a), to the input side of the monitor (b).

Connect a second cable from the output side of the monitor to the DS-69 (c). (This cable will plug into the jack on the ROMPACK)

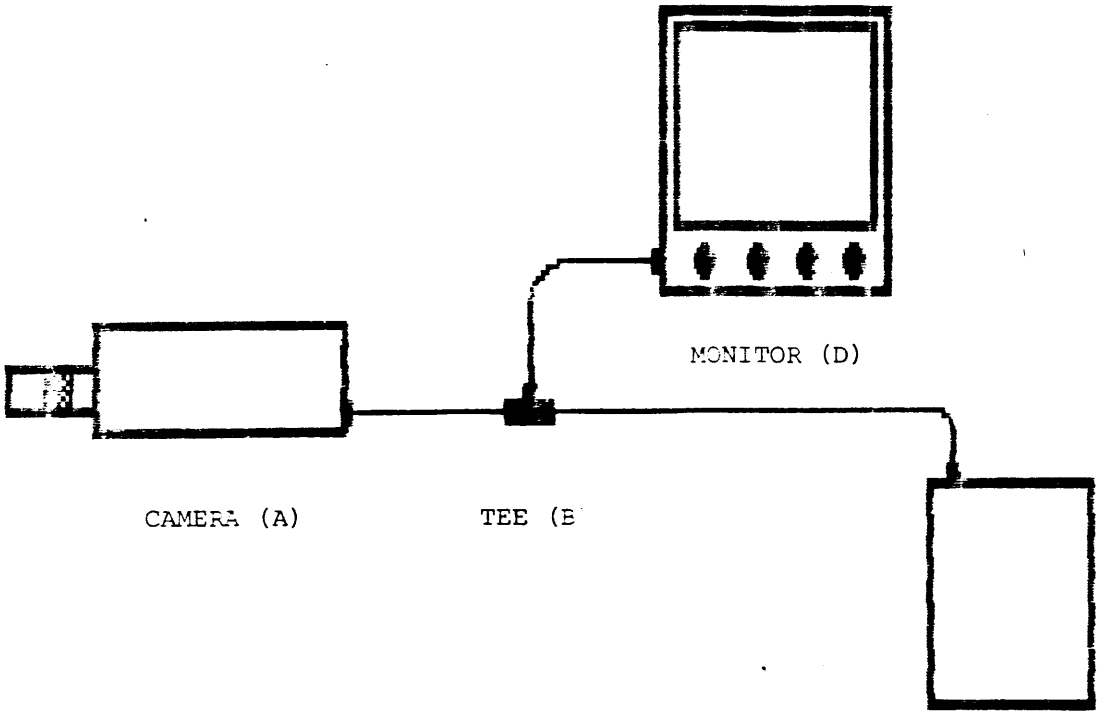


FIGURE 1

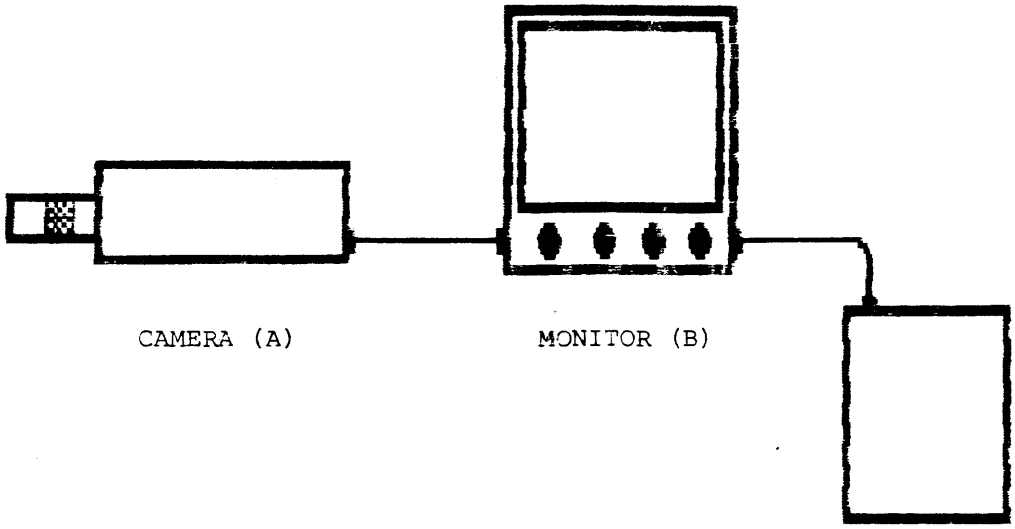


FIGURE 2

INSTALLATION

To install your DS-69 for disk operation:

1. Be sure all power is turned off.
2. Insert the disk controller in any slot of your Multi-Pak Interface or PBJ C-C bus (Multi-Pak users be sure to set the slot selector switch to the same slot that contains the disk controller.)
3. Insert the DS-69 in any remaining slot.
4. Connect your camera or other video source to the DS-69 through the RCA phono jack at the end of the DS-69 ROMPAK.
5. Turn on the Multi-Pak Interface.
6. Turn on the monitor.
7. Turn on the video source.
8. Turn on your Color Computer.

To install your DS-69 for cassette operation:

1. Be sure all power is turned off.
2. Insert the DS-69 directly into the ROMPAK port on the Color Computer.
3. Make sure the cassette recorder is properly connected.
4. Connect your camera or other video source to the DS-69 through the RCA phono jack at the end of the DS-69 ROMPAK.
5. Turn on the monitor.
6. Turn on the video source.
7. Turn on your Color Computer.

ABOUT YOUR C-SEE SOFTWARE

C-SEE is a proprietary software package included with the DS-69. It consists of a collection of programs, C-SEE, CONFIG, RANDAC, RANDACB, SLOWPIC, and BURGLAR.

C-SEE is a menu driven program that takes, displays, prints, saves, and loads pictures.

CONFIG is an initialization program for C-SEE that invokes the correct overlays for your Digisector, graphics editor, printer driver, and interface.

RANDAC and RANDACB allow for digitizing a full 256x256 image with 64 grey levels from BASIC (see page 16 for RANDAC use).

SLOWPIC and BURGLAR are sample programs for use with RANDAC and RANDACB.

The C-SEE disk is not copy protected and we suggest that you make a back-up copy FOR YOUR OWN USE and store the master in a safe place.

C-SEE (DISK VERSION)

Before using the C-SEE disk package, you must run the configuration program. This enables the computer to locate the Digisector and utilize the correct printer driver. When you first receive C-SEE, no printer driver has been installed. CONFIG combines the C-SEE program and the designated overlay files to make a single executable file. It you move your DS-69 to another slot or you change printers, you will have to run CONFIG again.

To use the configuration program, enter :

```
RUN"CONFIG"
```

The configuration program will ask for the version of the CoCo which you have. Specify model 1, 2, or 3.

The next question asks you to identify the model of the Digisector that you are using. Select the appropriate response.

You will then be asked for the type of multipak interface in your system. Options are the PBJ C-C Bus or Radio Shack's Multi-Pak. The slot number you will use for the DS-69 is entered next. Radio Shack will be numbered from 1 to 4 and PBJ will be from Ø to 5.

Now you select the graphics editor. If you do not intend to use an editor your response here does not matter. This option defines the filename extention that will be used with the 5 level pictures.

1. Magigraph (uses .MGF)
2. CoCoMax (uses .MAX)

If you specified that the Digisector will run in a CoCo 3, you will be asked whether you have an RGB or composite monitor.

The next question permits you to specify the processor speed.

The printer menu will be displayed. If you do not see your printer, press the ENTER key to see an additional list of printers. Enter the selection corresponding to your printer type and follow any special instructions given to you by the CONFIG program.

After you have answered these questions the CONFIG program will display your selections. If any of the selections are incorrect run the CONFIG program again. When the config program finishes it will print "DONE" on the screen and return you to the BASIC "OK" prompt. Now you may run C-SEE. To do so type:

```
RUN"C-SEE"
```

The display will show the message "BOOTING C-SEE" and then display the Main Menu.

C-SEE (TAPE VERSION)

The cassette version of C-SEE comes pre-configured for the most common printers. To load C-SEE from cassette type :

```
CLOADM"C-SEE/E" for an Epson printer.
CLOADM"C-SEE/D" for a Radio Shack printer.
CLOADM"C-SEE/P" for a C.Itoh printer.
CLOADM"C-SEE/O" for an Okidata printer
```

When loading is complete, type EXEC to start the program. Except for the absence of disk I/O functions and the configuration program, C-SEE from tape is just like C-SEE from disk.

MOVING C-SEE FROM TAPE TO DISK

If you wish to move your copy of C-SEE from tape to disk use the following steps.

1. Insert the master tape and type :

   ```
   CLOADM"C-SEE/E"
   ```

2. Insert a blank disk and type :

   ```
   SAVEM"C-SEE",&H0E00,&H3FFF,&H0E00
   ```

MOVING C-SEE FROM DISK TO TAPE

If you wish to move your copy of C-SEE from disk to tape use the following steps.

1. Run CONFIG to set-up C-SEE first

2. Insert the master disk and type :

   ```
   LOADM"C-SEE"
   ```

3. Insert a blank tape and type :

   ```
   CSAVEM"C-SEE",&H0E00,&H3FFF,&H0E00
   ```

RUNNING C-SEE

C-SEE is a menu driven program that allows you to use the keyboard or joysticks to operate the Digisector. Across the top of each menu there is a line defining the current 16 level image in memory as either a 128x128 or 256x256 image.

Available commands from C-SEE's Main Menu are:

KEY FUNCTION

C,B,V, or H - bring up control panel where:

- C - sets contrast (auto mode only).
- B - sets brightness (auto or manual mode).
- V - sets vertical dither (manual mode only).
- H - sets horizontal dither (manual mode only).

- T - take a single five level scan.
- G - take continuous five level scans.
- S - set up and take a 128x128 16 level image (CoCo 2).
  go to the 16 level menu (CoCo 3 only).
- I - set up and take a 256x256 16 level image (CoCo 2).
  no action taken with CoCo 3.
- K - display 16 level image (CoCo 2).
  no action taken with CoCo 3.
- D - go to the Disk Menu.
- A - go to the Cassette Menu.
- P - go to the Printer Menu.
- Q - return to BASIC.
- M - toggle between the main menu and the 5 level picture

Selections from all of C-SEE's menus are made by pressing a single key.

T. The "T" command initiates a single five level scan. The image is digitized and stored in the graphics page for display on the screen or transfer to disk, cassette, or printer.

G. This operation is identical to "T" except it continues scanning until another key is pressed. You can experiment with the brightness, contrast and dither controls while scanning to produce the desired effect. While the computer is scanning a picture pressing B, C, V, or H will allow you to adjust these controls during the scanning process. When you are ready to print or save the scan, press T (or the left joystick fire button). The display will switch to the full screen and then freeze the image after one additional scan. See the Adjustments section for a more detailed description of the controls. The 5 level scan does not modify the contents of the 16 level picture buffer.

S. and I. These operations digitize images of 16 grey levels and put the digitized information in a buffer for transfer to disk, tape or printer. If you have a CoCo 3, the S function goes to the 16 Level Menu and the I function is inoperative.

Pressing the S key will digitize a 128x128 image. The I key digitizes an image of 256x256 pixels. When you select a 16 level scan, the control panel will be displayed on the lower third of the screen. The top of the screen will display repeating 3 level scans. The display is non-linear in this mode so adjust the contrast and brightness levels for the brightest and darkest areas of the picture. When the controls are properly adjusted the display will be solid black and solid white in the appropriate areas with three shades of grey.

Press any key other than the cursors, C, or B keys, to start the scan. The 16 level scan takes 2 seconds with the DS-69 and 1/2 second with the DS-69B.

You can display a simplified version of the scan result on the Color Computer screen by pressing the K key. Or you can go to the Printer Menu and print the entire image on your printer.

K. This command displays a coarse representation of the 16 level picture. Since the Color Computer 2 is not capable of displaying 16 levels of grey or 16 colors, each pixel is displayed as a 2x2 dither matrix. While this does not give a lot of detail, it does display enough picture content to determine what the picture is. CoCo 3 users please refer to the 16 Level Menu description for display functions.

D. This command displays the Disk Menu. From here you can save and load pictures and get a directory of what is on the disk.

A. This command displays the Cassette Menu. This menu allows you to save and load pictures from cassette.

P. This command displays the Printer menu. You can print both the 5 level and 16 level pictures from here. Before using the printer commands be sure that you have selected the proper printer driver with the CONFIG program.

Q. Pressing Q returns you to BASIC.

M. Pressing the CLEAR or M keys will cause the display to toggle between the Main Menu and the 5 level picture graphics page.

Notes :

1. Magigraph, CoCoMax, and Graphicom will operate only on 5 level pictures. They cannot be used with the 16 level images.

2. 5 level picture samples shipped with the DS-69 were created for use with Magigraph and have the "/MGF" file extension. If you wish to use these files with CoCoMax, they must be renamed to change the extension to "/MAX", example :

RENAME "BEAR/MGF" TO "BEAR/MAX" <enter>

PRINTER OPERATION

Press P when you are in the Main Menu to go to the Printer Menu. At the top of the Printer Menu the current baud rate is displayed. Be sure this is correct before trying to print a picture. The Printer Menu gives you the following options:

KEY	FUNCTION
1	Print the graphics page (5 level scan).
2	Print the contents of the 16 level buffer.
3	Change the baud rate.
4	Return to main menu.

Before either 1 or 2 is selected, make sure the baud rate is correct for your printer. Refer to your printer manual for the correct baud rate.

1. This function prints the contents of the graphics page which contains the last 5 level scan.

2. This function prints the contents of the 16 level image buffer. C-SEE will automatically select either the 128x128 or 256x256 print routine acording to what is currently in memory. The current 16 level image mode is displayed at the top of the menu.

3. Each time this key is depressed the baud rate will double, up to a maximum of 9600. From 9600 the baud rate wraps around to 300 baud.

4. Returns control to the Main Menu.

DISK OPERATION

Press 'D' when you are in the Main Menu to display the Disk Menu.

C-SEE allows you to load and save picture files. Picture files, like all files, have filenames. A valid filename consists of a name with 1 to 8 characters, an optional extension of 1 to 3 characters, and an optional drive number. You will be prompted for a filename in options 2 through 5. If an extension is not given, C-SEE will use one of its own default extensions. If no drive number is given, C-SEE will use the default drive number displayed near the top of the menu.

KEY FUNCTION

1 - List files on disk.
2 - Save a 5 level picture.
3 - Load a 5 level picture.
4 - Save a 16 level image.
5 - Load a 16 level image.
6 - Save a Graphicom picture.
7 - Load a Graphicom picture.
8 - Set drive number.
9 - Return to main menu.

1. Display the directory of the current default drive.

2. Save a 5 level picture. This saves the 5 level picture in a format that can be loaded from BASIC using the LOADM command. The picture file will load into Disk Extended BASIC's default graphics page at $ØEØØ. The default extension for the 5 level pictures is either "/MGF" or "/MAX" depending upon the graphics editor you selected during the CONFIG program.

3. Load a 5 level picture. This will load a picture file from disk and overwrite any 5 level picture currently in memory. The file must be in the same format as when it was saved by C-SEE or BASIC using the SAVEM command.

4. Save a 16 level image. This command saves the contents of the 16 level image buffer. The disk file created by this command is not a loadable module, rather it is an 8K data file for 128x128 images and a 32K file for 256x256 images. The format of the file is described under 16 GREY SCALE ARRAY for those who wish to use these files with programs other than C-SEE. The default extension for the 16 level pictures is "/PIX".

5. Load a 16 level image. This command is used to retrieve a 16 level image file previously saved by C-SEE. Any 16 level image currently in memory will be overwritten. C-SEE will select the 16 level image mode according to the size of the file being loaded.

6. Save a Graphicom picture. This command writes the 5 level picture to a Graphicom format picture disk.

7. Load a Graphicom picture. This command allows you to load a picture from a Graphicom picture disk.

   After selecting a Graphicom menu option C-SEE will load the picture disk menu into memory from the default drive. Using the joystick you may select the appropriate picture. Pressing the fire button will either load or save the picture. Pressing the break key will allow you to return to the Disk Menu. Remember that these menu options use the default disk number, so set the drive number before trying to load or save to a picture disk.

8. Set the default drive. This command selects the next drive number as the default drive. Unless you specify a drive number for the other disk operations, the default drive displayed near the top of the screen will be used.

9. Returns program to Main Menu.

CASSETTE OPERATION

From the Main Menu, press 'A' to display the Cassette Menu.

KEY FUNCTION

1 - Save a 5 level picture.
2 - Load a 5 level picture.
3 - Save a 16 level picture.
4 - Load a 16 level picture.
5 - Skip a file.
6 - Return to Main Menu.

Options 1 through 5 will prompt you for the filename. If you select option 2 or 4, the tape must be positioned at the beginning of the file to be loaded.

1. Save a 5 level picture. This saves the 5 level picture in a format that can be loaded from BASIC using the CLOADM command. The picture file will load into Extended BASIC's default graphics page at $0600.

2. Load a 5 level picture. This will load a picture file from disk and overwrite any 5 level picture currently in memory. The file must be in the same format as when it was saved by C-SEE or BASIC using the CSAVEM command.

3. Save a 16 level picture. This option saves the contents of the 16 level picture buffer. The cassette file created by this command is not a BASIC loadable module.

4. Load a 16 level picture. This command is used to retrieve a 16 level picture file previously saved by C-SEE. Any 16 level picture currently in memory will be overwritten.

5. Skip a file on tape. This function is used to skip one or more files or to find the specific file that you are searching for. You will be asked for a file name to search for. (If none is given, C-SEE will skip over the next file on the cassette and stop.) When the specified name is found, that file will be skipped and C-SEE will stop before the following file, ignoring all other files.

   This feature can be used to ensure that you do not overwrite existing files on tape. Skip over your last file on the cassette before attempting to save a picture. C-SEE will not check to see if it is overwriting existing data.

   If the filename you specify cannot be found, C-SEE will continue searching indefinitely until either RESET is pressed or the computer is turned off. If you do turn off the computer, any picture you have in memory will be lost.

6. Returns program to Main Menu.

16 LEVEL MENU (CoCo 3 only)

From the main menu press 'S' to display the 16 Level Menu.

KEY FUNCTION

1 - Take 128 x 128.
2 - Take 256 x 256.
3 - Ordered Dither.
4 - Summation Dither.
5 - 16 Color Display.
6 - Return to Main Menu.

1. or 2. These options digitize images with either 128x128 or 256x256 pixels, using 16 levels of grey. The resulting picture is stored in the current 16 level picture buffer.

   When you press either 1 or 2, the control panel will be displayed on the lower third of the screen. The top of the screen will display repeating 3 level scans. The display is non-linear in this mode so adjust the contrast and brightness levels for the brightest and darkest areas of the picture. When the controls are properly adjusted the display will be solid black and solid white in the appropriate areas with three shades of grey. Press any key other than the cursors, C, or B keys, to start the scan.

3. This selection displays the current picture using a 2 by 2 dither pattern with four levels of grey. Oversampling techniques are used to increase picture resolution. This is a screen display only and cannot be printed.

4. Selecting the summation dither displays the current picture using the sampling techniques from the ordered dither, enhanced by an error propagation algorithm. This algorithm smooths points of data which appear to be erroneous. This is a screen display only and cannot be printed.

5. This selection allows you to assign colors to each of the 16 grey levels and displays the current picture using the chosen colors. When you press '5' from the menu, the current picture is displayed along with the current palette. You edit the palette using either the arrow keys or the joystick. Move the cursor appearing in the color palette left and right using the left and right arrow keys, or moving the joystick left and right. The button on the joystick must be depressed to be effective. The up and down arrows (or moving the joystick up and down) will alter the color in the current palette position.

   As you modify the colors in the palette, the current picture will reflect your changes. When you have selected the colors to your satisfaction, pressing any key on the keyboard will erase the palette display and show your complete picture. The colors you select will have no effect on printed output.

6. Returns program to the Main Menu.

ADJUSTMENTS

With C-SEE's five level digitizing routines there are two modes for adjustments.

a) Auto Mode
In this mode you set the contrast and brightness levels with your keyboard or joystick while C-SEE selects the horizontal and vertical dither levels. While in the auto mode, pressing V or H will result in a change to manual mode.

b) Manual Mode
In this mode, C-SEE sets the contrast, you set the brightness and both horizontal and vertical dither levels. While in manual mode, pressing C will result in a change to auto mode.

For a note on dithering, see the glossary.

Pressing the C,B,V, or H keys when in the Main Menu or while doing a continuous five level scan will display the control panel on the screen. The control panel shows the current value of each of the four adjustments. When you are in Auto Mode the dithering levels will be displayed as solid blocks to indicate that they are C-SEE selected. When you are in the Manual Mode the contrast level is displayed as a solid block to show that it is C-SEE selected. The adjustment mode you are using (auto or manual), is displayed in the upper right corner of the control panel.

The contrast and brightness adjustments act very much like the contrast and brightness knobs on your TV. The cursor (arrow) will point to the control to be adjusted. Use the "up arrow" and "down arrow" keys to raise and lower the levels. Press the C,B,V, or H keys to select a different control for adjustment. The left and right arrows move the cursor left and right. Contrast and brightness are alternately adjusted until the desired effect is achieved.

The 16 level scan utilizes the Auto Mode. When you press S, you get the set-up routine which permits you to see the contrast and brightness levels. The display wil show repeating three level scans and the control panel. Adjust the controls so that the brightest and darkest portions of the image that you are digitizing are correctly displayed. Be sure that some midtones are also displayed. Pressing the left joystick firebutton or the space bar on the keyboard will begin the digitizing process. Remember that it takes several seconds to digitize an entire image using the DS-69, so be sure your subject remains still for that length of time.

It can be more convenient to use a joystick to make adjustments. Attach a joystick to the right joystick port. Press the firebutton once to bring up the control panel with the cursor pointing at brightness. Center the joystick and press the firebutton again. The vertical position of the joystick now controls the brightness level. Moving the joystick to the left or right and pressing the firebutton causes the cursor to move left or right on the panel, selecting among the four different controls.

The left joystick can optionally be used to take pictures. In the 5 level scan, pressing the left joystick firebutton will allow you to take a single frame and stop. In the 16 level scan, pressing the left joystick firebutton will allow you to exit the set-up routine and take the 16 level picture.

WIDTH CONTROL

With some printers it may be necessary to adjust the width control on the DS-69 to get the most desirable aspect ratio. The aspect ratio refers to the height and width of the pixel. If the aspect ratio is incorrect, elongated or flattened images will result.

Insert a small standard screwdriver into the hole on the front of the DS-69. Turn the adjustment counterclockwise to increase the width, and clockwise to decrease the width until the desired aspect ratio is obtained.

Warning: Do not force the width control to turn; it will break.

RANDOM ACCESS FROM BASIC

The 'RANDAC.BAS' and 'RANDACB.BAS' programs supplied with the Digisector are machine language routines that support the full 256x256 spatial resolution and 64 grey levels provided by the DS-69 and DS-69B Digisectors. These routines may be used by BASIC programs to easily digitize any one of the 65,536 points in a video image. RANDAC programs are separate from the C-SEE software package and do not require C-SEE to operate. RANDAC is used with the DS-69. If you have a DS-69B, use RANDACB.

From disk enter:

```
RUN"RANDAC" or RUN"RANDACB"
```

From tape enter:

```
CLOAD"RANDAC" or CLOAD"RANDACB"
RUN
```

From this point on both RANDAC and RANDACB operate in the same manner. When you run RANDAC you will be asked for the slot number where the Digisector is currently located. RANDAC will install itself in memory above the stack and strings and then vanish, well out of the way of a BASIC program.

Next, load your BASIC program. There are two ways to call the RANDAC routine from a BASIC program. The first one is to use PEEK, POKE, and EXEC as follows:

```
10 POKE 241,X-coordinate
20 POKE 242,Y-coordinate
30 EXEC
40 BRIGHTNESS = PEEK(243)
```

The example above will retrieve the brightness value of the single point specified by X and Y.

RANDAC can also be accessed by the USR function built into BASIC. The execution address of RANDAC is stored at locations 157 and 158 decimal when RANDAC is first loaded and run (157 is the Most Significant Byte of the address). In order to define the user function to start at the address stored at the above locations enter the following:

```
10 DEF USRn = (PEEK (157) * 256 + PEEK (158))
20 BRIGHTNESS = USRn (256 * X + Y)
```

where: X is the x-coordinate
Y is the y-coordinate
n is the USR function number, from 0 to 9

Remember that (Ø,Ø) is the upper left corner of the video image and (255,255) is the lower right. The brightness levels that RANDAC returns for the active portion of the video signal will have a range between Ø and 63, depending on the characteristics of your video source.

Two sample programs for using RANDAC have been included on the C-SEE disk.

SLOWPIC.BAS — Digitizes a 256x256 image and stores it on disk. The program will ask you for a filename to use. This requires 64k of disk space or 29 granules.

BURGLAR.BAS — Digitizes a portion of an image repetitively and looks for any changes in the picture. When something moves, a change in the image will be detected.

WRITING CUSTOM PRINTER DRIVERS

Writing your own custom printer driver for use with C-SEE requires a working knowledge of the MC6809 assembly language and the inner workings of the Radio Shack Color Computer.

There are a number of rules that must be followed when writing a driver program for C-SEE :

1. The driver must load entirely within memory locations $3800 thru $3FFF inclusive.

2. Location $3800 must contain a jump table to the three different print routines. An example of the jump table follows:

```
JMP     SCRPRT  * print the screen
JMP     PRT128  * print the 128x128 picture
JMP     PRT256  * print the 256x256 picture
```

3. Do NOT modify any memory within the following ranges :

   $0000 Thru $03FF
   $0600 Thru $37FF
   $4000 Thru $D7FF

   Memory above $D800 is available for use as buffers and scratch pads.

4. Leave the computer in the same state it was in when your routine was called by C-SEE. If you change the state of the PIA control registers, VDG, SAM, Multipak, etc., change them back to the state in which C-SEE left them. Changing the state of certain registers in memory will cause the DS-69 to hang the next time it is used.

There are two routines provided from within C-SEE for printer drivers. Use of any other routines or memory within C-SEE is not recomended.

The first routine is a print character routine. It sends the character in the A accumulator to the printer.

The second routine sends a string of characters to the printer. On entry the U index register should be pointing to the string to be printed. The format of the string is as follows :

<length><string data>

Example :

```
FCB     06
FCC     027,064,027,075,00,01
```

The first byte is the length of the string to be printed, from 1 to 255. The data contained within the string is not modified by the print routine.

Both of these routines preserve all registers and do not return status. No error checking or boundary checking is performed on the data. Sample printer drivers are availaible as examples of how to use these routines and how to print the 16 level images.

If you develop a custom printer driver for C-SEE and would care to share it with other users of C-SEE, The Micro Works will distribute the program as a public domain addition to C-SEE. In order for us to do this, we require that you send the driver and the source code on diskette, along with any special instructions for using the driver.

C-SEE III MEMORY MAP

The only difference in the memory map between the 128x128 mode and the 256x256 mode is the amount of memory used to store the image.

128x128 GREY SCALE MODE

```
$0000 - $00FF : C-SEE and BASIC scratch pad
$0100 - $01FF : BASIC jump tables
$0200 - $02FF : temporary storage {re-useable}
$0300 - $03FF : C-SEE stack
$0400 - $05FF : text screen
$0600 - $0DFF : disk scratch pad
$0E00 - $37FF : C-SEE
$3800 - $3FFF : printer driver
$4000 - $57FF : 5 level picure
$5800 - $77FF : 128x128 16 grey scale image
$7800 - $97FF : scan buffer #0 {re-useable}
$9800 - $B7FF : scan buffer #1 {re-useable}
$B800 - $D7FF : scan buffer #2 {re-useable}
$D800 - $F7FF : scan buffer #3 {re-useable}
$F800 - $FEFF : not used by C-SEE
```

256x256 GREY SCALE MODE

```
$0000 - $00FF : C-SEE and BASIC scratch pad
$0100 - $01FF : BASIC jump tables
$0200 - $02FF : temporary storage {re-useable}
$0300 - $03FF : C-SEE stack
$0400 - $05FF : text screen
$0600 - $0DFF : disk scratch pad
$0E00 - $37FF : C-SEE
$3800 - $3FFF : printer driver
$4000 - $57FF : 5 level picure
$5800 - $D7FF : 256x256 16 grey scale image
$D800 - $F7FF : scan buffer {re-useable}
$F800 - $FEFF : not used by C-SEE
```

Note : The areas marked re-useable may be used as temporary storage for the printer drivers.

Warning : C-SEE also uses this memory for temporary storage.

128x128 AND 256x256 16 GREY SCALE ARRAY

A picture is an orderly collection of tiny points of varying brightness. The variety of nature provides us with an infinite number of different brightnesses between black and white. It's an analog world! The human eye can only perceive twenty or thirty brightness levels at a time. This is fortunate since the Color Computer, being a digital device, doesn't have room for an infinite number of anything! The Color Computer does have room to break down the brightness into 16 different shades of grey between black and white. As for the little tiny points, of which there are an infinite number also, the same story holds. So we break the picture down into 128 points (pixels) horizontally by 128 vertically. A different mode can be used to create a picture with 256 points horizontally and 256 vertically. The 16 grey scale array produced by the C-SEE software package contains all of the information necessary to generate a picture of 128x128 or 256x256 pixels with 16 grey scales per pixel.

If you are using the 128x128 mode the array is stored in a column major form from $D800 thru $77FF; a total of 8,192 bytes. There are 128 columns consisting of 64 bytes each. Each byte within the array contains 2 pixels of 4 bits each. Pixel 0,0 of the picture is at location $5800 in the Most Significant Nibble (MSN). Pixel 0,1 is also at location $5800 but stored in the Least Significant Nibble (LSN). Pixel 1,0 is at $5840 in the MSN, etc.

$5800	$5840	$5880	$58C0	$5900
MSN = (0,0)	MSN = (1,0)	MSN = (2,0)	MSN = (3,0)	MSN = (4,0)
LSN = (0,1)	LSN = (1,1)	LSN = (2,1)	LSN = (3,1)	LSN = (4,1)

$5801	$5841	$5881	$58C1
MSN = (0,2)	MSN = (1,2)	MSN = (2,2)	MSN = (3,2)
LSN = (0,3)	LSN = (1,3)	LSN = (2,3)	LSN = (3,3)

$5802	$5842	$5882
MSN = (0,4)	MSN = (1,4)	MSN = (2,4)
LSN = (0,5)	LSN = (1,5)	LSN = (2,5)

$5803	$5843
MSN = (0,6)	MSN = (1,6)
LSN = (0,7)	LSN = (1,7)

The array is stored on diskette in the same format as it is in memory.

If you are using the 256x256 mode the array is stored in a column major form from $5800 thru $D7FF; a total of 32,768 bytes. There are 256 columns consisting of 128 bytes each. Each byte within the array contains 2 pixels of 4 bits each. Pixel 0,0 of the picture is at location $5800 in the Most Significant Nibble (MSN). Pixel 0,1 is also at location $5800 but stored in the Least Significant Nibble (LSN). Pixel 1,0 is at $5880 in the MSN, etc.

$5800	$5880	$5900	$5980	$5A00
MSN = (0,0)	MSN = (1,0)	MSN = (2,0)	MSN = (3,0)	MSN = (4,0)
LSN = (0,1)	LSN = (1,1)	LSN = (2,1)	LSN = (3,1)	LSN = (4,1)

$5801	$5881	$5901	$5981
MSN = (0,2)	MSN = (1,2)	MSN = (2,2)	MSN = (3,2)
LSN = (0,3)	LSN = (1,3)	LSN = (2,3)	LSN = (3,3)

$5802	$5882	$5902
MSN = (0,4)	MSN = (1,4)	MSN = (2,4)
LSN = (0,5)	LSN = (1,5)	LSN = (2,5)

$5803	$5883
MSN = (0,6)	MSN = (1,6)
LSN = (0,7)	LSN = (1,7)

The array is stored on diskette in the same format as it is in memory.

TROUBLESHOOTING

There are a few common problems that occur when someone is first using the DS-69 and C-SEE software. Before calling The Micro Works with a problem, check to see that it is not on this list.

Problem 1 : When printing a picture on my printer all I get is garbage.

Solution : 1. C-SEE does not currently support your printer.

2. The wrong printer type was selected in the CONFIG program.

3. CONFIG was not run at all.

4. The BAUD rate is incorrect.

Problem 2 : I can't take a picture using my video cassette recorder or video disk player.

Solution : 1. Be sure that the DS-69 is connected to the video output on the back of the player and not the antenna's connection used with your TV set.

2. Make sure that the player is turned on and running in the freeze frame mode, not the pause mode. When you are trying to digitize an image using your VCR you should be able to see a clear picture on a TV connected to the output of the player.

3. If you are using a camera with a VCR make sure that the camera is connected to the VCR and that the DS-69 is connected to the video output. Also check the owners manual for instructions on how to use the camera/VCR combination.

4. If you have a monitor connected inline to the video input of the DS-69 make sure that it is a non-terminated monitor.

Problem 3 : Why can't I use my C-C Bus?

Solution : 1. Be sure that you selected the PBJ C-C bus in the CONFIG program and that you have the DS-69 in the proper slot number. If you are unsure of this, run the CONFIG program again and re-setup your system.

2. You also must have a jumper installed before the PBJ Bus can be used. Included with this manual is a diagram showing where this jumper is to be placed. If you are not a technically inclined person, please refer to a qualifed technician or the place you purchased the C-C bus.

GLOSSARY

ASPECT RATIO	The ratio between the height and the width of the pixel, so that a 1:1 aspect ratio is a square pixel. The aspect ratio of a standard television set is 4:3.
BAUD RATE	The rate in bits per second at which data is transmitted.
BUFFER	A memory storage space for text or other data.
DITHER	A procedure for trading off spatial resolution for perceived grey scales, similar to half toning in a newspaper picture.
EXEC ADDRESS	The memory location at which to begin the execution of a machine language program.
PAGE ONE	The first page of graphics memory storage in the Color Computer.
PIXEL	Picture Element: The smallest individual point in an image.
SPATIAL RESOLUTION	The number of pixels vertically and horizontally in an image.
TERMINATION	Having a 75 ohm resistor between the video source and ground.
VIDICON	A vacuum tube in a video camera that converts the visible image into an electronic signal.

WARRANTY INFORMATION

HARDWARE WARRANTY

The Micro Works warrants the DS-69 hardware to be free from defects in workmanship and materials for a period of one year from the date of purchase. IT IS EXPRESSLY AGREED THAT THIS ONE YEAR WARRANTY SHALL BE IN LIEU OF OTHER EXPRESS WARRANTIES, WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY. No agent, employee or representative of The Micro Works has the authority to alter the obligation of this warranty.

This warranty shall not apply to any Micro Works product damaged as a result of abuse, misuse, accident, or neglect.

This warranty shall not apply if the sealed case has been opened.

IN NO EVENT SHALL THE MICRO WORKS BE LIABLE FOR CONSEQUENTIAL DAMAGES.

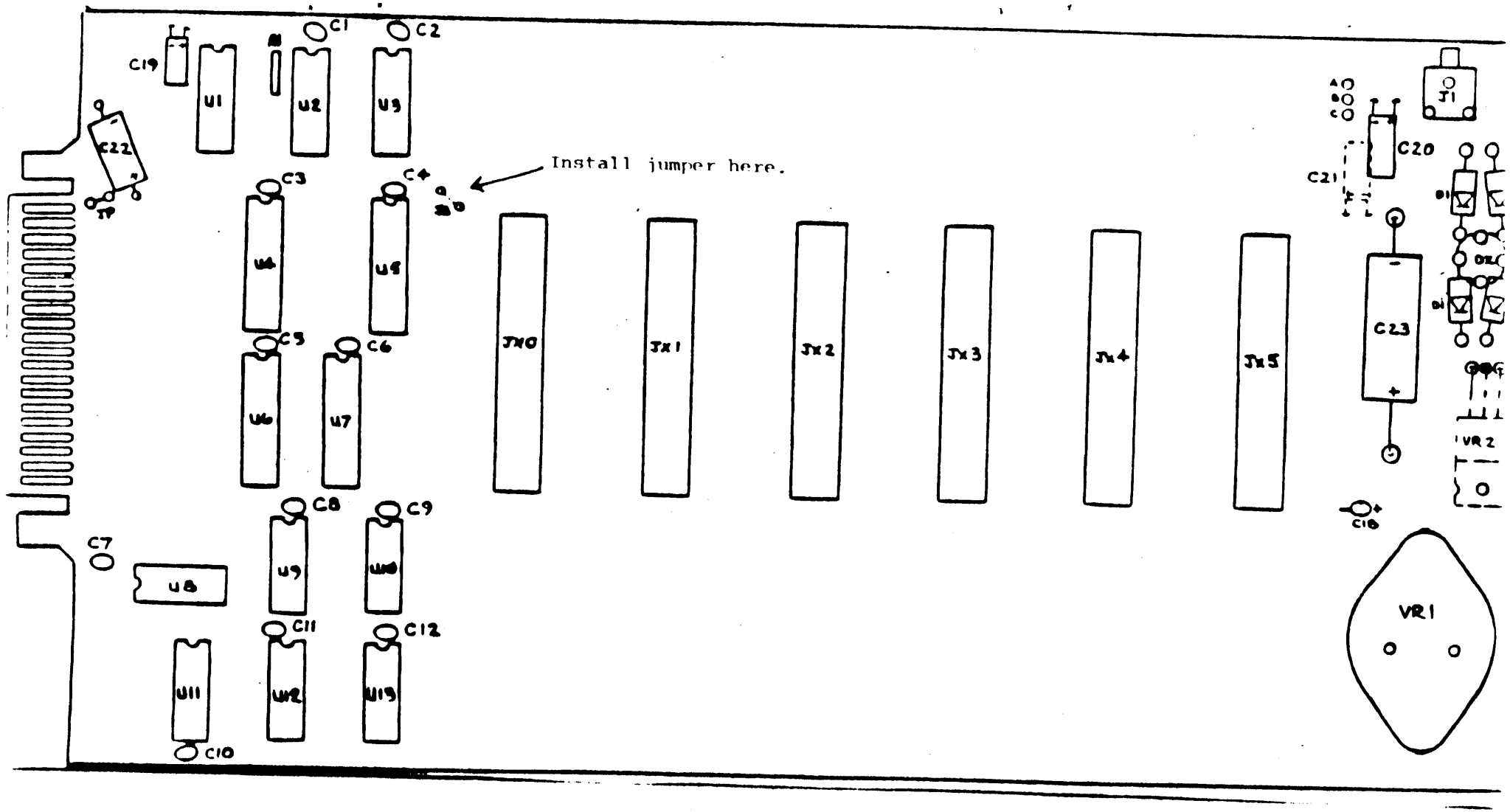
IN ORDER TO MAKE A CLAIM AGAINST THIS WARRANTY, THE DEFECTIVE UNIT MUST BE RETURNED BY PRIVATE CARRIER OR THE U.S. POSTAL SERVICE TO: THE MICRO WORKS, P.O. BOX 1110, DEL MAR, CA 92014. PRINTED CIRCUIT BOARDS MUST BE ACCOMPANIED BY THE SALES RECEIPT SHOWING DATE OF PURCHASE. We suggest that shipments be insured.

HARDWARE REPAIRS

At any time after the one year warranty period, The Micro Works will repair your DS-69 board for a reasonable fee. If repairs are necessary, carefully package the board and return it to The Micro Works at the above address. Please include a detailed description of the problem.

SOFTWARE WARRANTY

Micro Works software is provided as-is without warranty. Reasonable care has been taken to ensure that the programs operate as described. If you find discrepancies or errors, please notify us. We will attempt to correct any errors brought to our attention, but we make no guarantee to do so.



NOTE TO USERS OF THE PBJ C-C BUS

In order for the DS-69 to function properly with the C-C Bus, CART* must be connected to the bus. A jumper wire must be soldered to the underside of the board as indicated above.

*Interrupt Input for Cartridge Detection