

PART II - INTERACTIVE DAZZLER PLOTTING



## Chapter 6: LOADING AND EXECUTING DAZZPLOT

Dazzleplot is a program which provides one with fast and simple control over the Dazzler hardware for many kinds of plotting and drawing. This software does all of the translation between simple up/down, left/right instructions and the complex memory storage required by the Dazzler. The program also performs a number of special purpose functions such as clearing the screen, drawing coordinate axes with tic marks, changing among several different picture buffers, selecting high/low resolution and intensity, providing complete cursor control, and a number of others. Dazzleplot is stored on the disk under the name DAZZPLOT.COM. Since it is a .COM file, its name may be typed directly from CDOS and it will load from the disk and start executing at 100H. Input to DAZZPLOT may be provided from two sources: input from the CROMEMCO Joysticks and input from the console keyboard. These are described in detail in Chapter 7. (The first of these requires a pair of CROMEMCO JS-1 Joysticks interfaced through a D+7A analog-to-digital board.)

The hardware requirements to run Dazzleplot are not as extensive as for the Dazzler Graphics package. 16K of memory and the Dazzler itself are sufficient to operate DAZZPLOT. However, to take advantage of all 16 of the available picture buffers, 48K of memory is required. Dazzleplot is loaded and begins execution at 100H as mentioned; however, it then immediately moves itself in memory to just below the operating system (CDOS) and executes from this location. It then clears picture buffers 0 (location 200H) and 1 (location A00H), as this is where DAZZPLOT itself was originally loaded. The

reason for this move to high memory is the following: From locations 100H to 200H in memory, DAZZPLOT stores a short program which will turn on picture buffer 0. Thus, at any point during execution of Dazzleplot, you may save what you are doing on disk by performing the following steps:

- 1) Use the CTRL-E or exchange command to move the picture buffer which you are currently using to the buffer 0 position.
- 2) Press the ESCape key to exit from Dazzleplot and return to CDOS.
- 3) Type the command:  
    SAVE filename.COM 9  
    where filename is replaced by a name of your choice  
    and where 9 is the number of 256-byte blocks required  
    to save picture buffer 0 on the disk.

To reload this buffer and display it at any time in the future, simply type the filename (since it is a .COM file). The picture will be loaded into memory and the Dazzler will be turned on at the correct location by a short program at 100H. To return to DAZZPLOT simply type "D"; however, be sure DAZZPLOT actually resides in memory before doing this.

If Dazzleplot is executed when there is insufficient memory in the user area for all 16 picture buffers (for example, with a 32K CDOS), it will automatically print an error message if one of the illegal buffers is selected by use of the CTRL-W command. Each Dazzler picture buffer requires 2K of RAM. The starting addresses of these are listed in Table 7-5.

## Chapter 7: DAZZLEPLOT CONTROL COMMANDS

There are quite a number of input commands recognized by Dazzleplot and for ease of explanation they can be broken into three groups. Each of these groups of commands is described separately in this chapter. The first group of numeric character inputs control the movement of the cursor or actual plotting or drawing process. Each time one of the numeric characters is entered the current cursor location is moved accordingly and the current color or black and white intensity is deposited at this new location. The color and/or intensity is specified by the second group of input alphabetic commands. The color can be specified or changed at any time and remains the same until a new color is input. Thus, after specifying a color or intensity several movements can be input and this same color will be used to draw the line specified by these movement commands. The third group of input commands are control characters. These are used to alter the basic operating characteristics of Dazzleplot such as high/low resolution, color/black and white mode, cursor on/off/blink, reverse background on/off, and several others.

Inputs from any of these three groups may be freely mixed at any time with predictable, although sometimes unusual, results. For example, if you have drawn some figure in high resolution mode and then enter CTRL-L (change to low resolution), the resulting drawing may appear rather strange. While in the high resolution mode all points are the same color (128 by 128 grid). When you change to low resolution, each point can be any of 16 colors or intensities (64 by 64 grid).

One of the CROMEMCO JS-1 Joysticks may also be used as input to Dazzleplot. This actually provides for the most interactive method of control of cursor movement. When using Joystick

as an input to this program, the Joystick movement replaces (actually duplicates) the numeric input commands. When you move the Joystick up the cursor moves up, and when you move it to the right the cursor moves right, and so on for all directions of movement. As you move the cursor, the specified color or intensity will be deposited in the picture storage area. Also, it is important to note that the speed of cursor movement is dependent upon how far the Joystick is displaced from its zero or rest position. (This zero position may have to be adjusted initially by use of the vertical and horizontal trimmer pots which are mounted on the face of the Joystick. If the cursor is moving across the screen on its own when you first execute DAZZPLOT, simply adjust these for zero movement.)

The four buttons on the JS-1 console have been assigned four often used control functions. These predefined functions are as follows:

- |                   |  |
|-------------------|--|
| Button 1 - CTRL-C | Center cursor without screen clear.            |
| Button 2 - CTRL-O | Move cursor to lower left corner<br>(X=0,Y=0). |
| Button 3 - CTRL-A | Draw coordinate axes.                          |
| Button 4 - CTRL-P | Print out X and Y coordinates of cursor.       |

These functions are provided as a convenience to the user doing interactive plotting with the Joystick. Note that their functions may be duplicated at the keyboard.

#### Cursor Movement Controls

The movement of the cursor and thus all drawing or plotting is controlled with eight numeric input commands (ASCII '1'-'4' and '6'-'9'). Entry of any one of these numeric commands moves the cursor by exactly one position in the appropriate direction. Coincident with such a move is the depositing of a color or intensity in this new location. The choice of which color or intensity is to be deposited is determined by the last alphabetic

color command entered prior to the numeric move command. The allowed numeric input commands and their meanings are defined as follows:

<u>ASCII</u>	<u>MOVEMENT</u>
8	Up
2	Down
4	Left
6	Right
9	Up and Right
3	Down and Right
1	Down and Left
7	Up and Left
5	No Effect

Table 7-1. Console Cursor Controls.

Note that these numeric command assignments correspond in direction to imaginary pointers which are part of the adding machine type of number keypad found on many terminals such as the CROMEMCO 3100-series CRT's (see Figure 7-1). For example, the command 9 means move towards the upper-right, and the number 9 key is in the upper-right corner of the keypad.

7	8	9
4	5	6
1	2	3
0 (not used)		. (n.u.)

Figure 7-1. Standard Adding Machine Keypad.

## Color and Intensity Controls

The color and/or intensity of points drawn with Dazzleplot are controlled through the use of this set of alphabetic color commands. Executing one of these commands changes a color/intensity flag which will be used to load a picture storage location upon entry of the next move command (whether numeric from keyboard or a displacement from Joystick). When Dazzleplot is in the high resolution mode (128 by 128 grid), this color flag is used to specify the color of the entire plot because in this mode all points can have only one of two values, on or off. However, in the low resolution mode (64 by 64 grid) this color flag is used to load the appropriate 4-bit nybble into the picture storage area. In this mode each point can have one of 16 intensities or colors. Thus, in low resolution you can draw multicolored plots, diagrams, or any other kind of picture.

The exact 4-bit combination which is loaded into the color flag is specified by a set of eight color commands which are used together with two intensity commands. Since the two intensity commands are independent of the eight color commands, a total of 16 possible combinations are allowed. It is important to remember that the two intensity commands (H and L) can be changed without altering the color command and vice versa. What this means is that you must set both a color and an intensity before you can know what will be deposited at the next move location. Points will continue to be plotted in this color or intensity until a new one is selected. The exact commands and their effect are given in the following table.

<u>ASCII</u>	<u>COLOR</u>	<u>GRAY SHADE</u>	
'N'	No Change or Black	Black	Gray 8
'R'	Red	Gray 1	Gray 9
'G'	Green	Gray 2	Gray 10
'Y'	Yellow	Gray 3	Gray 11
'B'	Blue	Gray 4	Gray 12
'M'	Magenta	Gray 5	Gray 13
'C'	Cyan	Gray 6	Gray 14
'W'	White	Gray 7	White
-----			
'H'	High Intensity		X
'L'	Low Intensity	X	

Table 7-2. Color and Intensity Controls.



## Program Control Commands

Dazzleplot recognizes a number of different control commands which can alter most of the operating characteristics of the program itself as well as the operation of the Dazzler hardware. These commands can be divided into five major areas of operation and are so-outlined in Table 7-3. Their detailed descriptions are given in alphabetic order in the following text.

### Control-A (ASCII 'SOH' = 01H)

This command draws a pair of X and Y axes to be used for subsequent plots. When in the normal background mode, these axes are white on black and when in the reverse mode, they are black on white. The two axes intersect at the current cursor location as it was defined immediately prior to entering this command. The axes have "tic" marks at specified intervals to indicate X and Y values quantitatively. As initialized there is a tic mark every tenth point from the origin along each axis. This setting may be changed by the CTRL-I command.

### Control-B (ASCII 'STX' = 02H)

This command sets the cursor in a blinking mode so that it is always visible as a blinking white cross. Otherwise, operation in this mode is identical to operation in the cursor-on mode (CTRL-N).

### Control-C (ASCII 'ETX' = 03H)

This command centers the cursor on the screen (X=127,Y=127) without clearing or altering the display.

### Control-E (ASCII 'ENG' = 05H)

This command is used to exchange the currently selected picture buffer with the "base" or zeroth buffer. This is useful

## 1. Memory Control

- CTRL-E      Exchange one of the alternate picture buffers with the base picture buffer at location 200H.
- CTRL-S      Select alternate picture buffer (up to 16 possible).

## 2. Picture Characteristics Control

- CTRL-H      Set to High resolution mode (128x128).
- CTRL-L      Set to Low resolution mode (64x64).
- CTRL-X      Set Dazzler to Black/White mode.
- CTRL-Z      Set Dazzler to Color mode.
- CTRL-Q      Select normal picture background.
- CTRL-R      Select complementary (Reverse) picture background.

## 3. Cursor Display and Location Control

- CTRL-B      Select cursor-blinking.
- CTRL-N      Select cursor-always-on.
- CTRL-F      Select cursor-always-off.
- CTRL-C      Center cursor on screen with no screen-clear.
- CTRL-K      Center cursor and clear (remember Klear) picture buffer (cleared to white if complementary background has been selected).
- CTRL-O      Move cursor to Origin or lower-left corner of screen; (X,Y)=(0,0).
- CTRL-P      Print the current cursor Position (X,Y) on the console. These values are in the range 0-255 as they were for the Dazzler Graphics routines.

## 4. X and Y Axes Control

- CTRL-A      Draw a pair of X-Y Axes centered at the current cursor location and having tic-marks at the current spacing.
- CTRL-I      Change tic-mark Interval spacing (0 through 15 possible).

## 5. Program Entry and Exit Control

- CTRL-J      Re-initialize DAZZPLOT flags and parameters.
- ESC          Turn off Dazzler, exit Dazzleplot, and return to CDOS.

Table 7-3. Dazzleplot Control Characters and Their Functions.

if it is desired to save a particular picture on the disk--the buffer can first be exchanged into the base buffer, then saved by a command of the format:

SAVE [D:]filename.[ext] 9

If the optional 3-letter extension .COM is used, this picture may be viewed at any later time simply by typing the filename.

Because DAZZPLOT clears the base picture buffer (as well as the next following buffer--see Chapter 6), the exchange command may also be used to transfer either of these two buffers elsewhere in memory so that DAZZPLOT may at a later time be re-loaded from the disk. Note that following execution of CTRL-E the current buffer remains selected, although its contents will have changed.

Control-F (ASCII 'ACK' = 06H)

This command turns off the cursor and makes it invisible on the display. Even though invisible, a current cursor position is always maintained by Dazzleplot and operation is the same as if a cursor were visible. In all cases except the No Change condition (combination 'L' and 'N' commands) a visible line can be seen to appear when move instructions are entered. In these cases the next point to be drawn will always be adjacent to the last one and in the direction specified by the next move instruction.

Control-H (ASCII 'BS' = 08H)

This command sets the Dazzler in high resolution mode. In this mode the display is made of 128 by 128 points, each of which can have only one of two possible values, on or off. The color currently selected will determine the color of the entire picture when in this mode.

Control-I (ASCII 'HT' = 09H)

This command is always immediately followed by a single key input from the keyboard, whose possible values are summarized in Table 7-4. The command together with the single input immediately following it specifies the interval between tic marks on the (X,Y) axes drawn by CTRL-A. The interval between tic marks can be set to any integer value between 0 and 15 by following Control-I with an ASCII '0' through 'F', corresponding to the hex numbers 0-F. For example, the default interval of 10 can be restored after some change by typing Control-I immediately followed by the letter 'A'.

<u>Hex Number</u>	<u>Tic Mark Interval</u>
0	0 (no tic marks)
1	1 (solid tic marks)
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10 (default value)
B	11
C	12
D	13
E	14
F	15

Table 7-4. Tic Mark Intervals for CTRL-I Command.

Control-J (ASCII 'LF' = 0AH)

This command initializes the critical flags for Dazzleplot and is always called upon program entry. However, if you wish to reinitialize Dazzleplot after some time in use you need only enter Control-J. Reinitializing performs the following functions: the display is returned to high intensity white, high resolution

color mode with a blinking cursor; the tic mark spacing is internally reset to the default value of 10, although this will not be visible until the next time CTRL-A is used; the reverse background flag is set to normal so that subsequent plotting will be done with the normal colors (not their complements); and picture buffer 0 is again selected as the current buffer.

Control-K (ASCII 'VT' = 0BH)

This command actually performs two functions: first, it clears the display memory of the currently selected buffer, and then it defines the current cursor position to be in the center of the display. When in the normal background mode, the display is cleared to black (memory = 0H). When in the reverse background mode, this command clears the display to white (memory = FFH).

Control-L (ASCII 'FF' = 0CH)

This command sets the Dazzler in low resolution mode. In this mode the display is made of 64 by 64 points, each of which can have either any one of 16 possible colors or shades of gray. The specific colors which are allowed are listed together in table 7-2.

Control-N (ASCII 'SO' = 0EH)

This command turns on the cursor and makes it visible on the display at all times. When in this mode, the cursor is represented by a white cross on the display which moves so that the point in the center of the cross is always the point which has most recently been loaded or drawn. Thus, the next point to be drawn will be adjacent to this and in the direction specified by the next move instruction. When in the reverse background mode, the cursor is a black cross.

Control-O (ASCII 'SI' = 0FH)

This command moves the current cursor location to the lower left hand corner of the display. This location is defined as X=0 and Y=0 and is commonly used as the origin for plots (especially plots occurring entirely in quadrant I of the Cartesian plane). For reference the maximum values of X and Y are (X=255,Y=255). Points plotted are automatically scaled to this even if the resolution of the hardware device (in this case the Dazzler) is less.

Control-P (ASCII 'DLE' = 10H)

This command calculates and prints out on the console the X and Y values of the current cursor location. These values are always in the range 0-255 regardless of the resolution currently selected.

Control-Q (ASCII 'DC1' = 11H)

This command sets a normal background for drawing. This means that for high resolution you will draw white or color lines on a black background. For low resolution the actual colors given in table 7-2 are loaded into memory when drawing.

Control-R (ASCII 'DC2' = 12H)

This command produces a reverse background condition with respect to the condition described for Control-Q. When in high resolution mode, this command produces a black drawing on a white or color background. In low resolution mode the complement of the selected color in table 7-2 is loaded into memory when drawing. Note that the effect of this command is not apparent until plotting is actually done. It has no effect on already-plotted points in the picture buffer.

Control-S (ASCII 'DC3' = 13H)

This command is always immediately followed by a single key input from the keyboard, whose possible values are summarized in Table 7-5. The command is used to change the memory location of the picture storage area to any one of 16 possible addresses; i.e., it is used to select one of 16 possible picture buffers. The allowed addresses are also given in Table 7-5. DAZZPLOT always executes from the highest possible portion of the CDOS user area, and the picture buffers are located below that. Therefore, if a smaller CDOS size is used (e.g., 32K), there will not be sufficient memory for all 16 picture buffers. The CTRL-S command automatically checks for this and will print a warning to the console if an out of range buffer is selected.

<u>Hex Number</u>	<u>Picture Buffer</u>	<u>Memory Start Addresses</u>
0	First	200H
1	Second	A00H
2	Third	1200H
3	Fourth	1A00H
4	Fifth	2200H
5	Sixth	2A00H
6	Seventh	3200H
7	Eighth	3A00H
8	Ninth	4200H
9	Tenth	4A00H
A	Eleventh	5200H
B	Twelfth	5A00H
C	Thirteenth	6200H
D	Fourteenth	6A00H
E	Fifteenth	7200H
F	Sixteenth	7A00H

Table 7-5. Numbers and Addresses of the 16 Possible Picture Buffers.

Control-X (ASCII 'CAN' = 18H)

This command puts the Dazzler in black and white mode.

When in high resolution mode, this command will produce binary black and white drawings or plots. When in low resolution, this command will produce drawings with up to 16 different shades of gray. This mode can be used to display or reproduce photographic-like images or actual digitized photographs. In this mode the gray level intensity is determined as described in table 7-2 for levels of 0 to 15.

Control-Z (ASCII 'SUB' = 1AH)

This command puts the Dazzler in color mode. In high resolution mode this results in a single-color plot. In low resolution mode this allows you to draw or plot multicolor pictures with up to 16 different colors (8 each for both high and low intensities--see Table 7-2).

ESCAPE Command (ASCII 'ESC' = 1BH)

This command is used to return to CDOS. It will first turn off the Dazzler and then execute a jump to location 0, the warm start for CDOS. Note that you may return to DAZZPLOT (if ESC was pressed accidentally) by using RDOS to "G100" and then typing "D" for DAZZPLOT in response to the console message.



## Chapter 8: CONCLUSION AND EXAMPLE OF USE OF DAZZPLOT

The example following is designed to acquaint the beginning user of Dazzler plotting routines with some of the color and motion changes possible. Simply perform the numbered steps below:

- 1) Insert your DGR diskette in drive-A of the computer and boot-up CDOS.
- 2) Now type the word "DAZZPLOT" to load and execute the program.
- 3) Press CTRL-K to clear the picture buffer (after the sign-on message has been printed).
- 4) Press CTRL-A to plot X-Y axes centered at X=127, Y=127.
- 5) Now press CTRL-W immediately followed by the character "1" to select picture buffer 1 (press CTRL-W,0 at any time to return to the first buffer).
- 6) Press CTRL-L to select low resolution (64x64) followed by CTRL-K to clear the picture buffer.
- 7) Press CTRL-O to move the cursor to the origin.
- 8) Press CTRL-A to plot the axes centered at the origin (X=0,Y=0).
- 9) Now press CTRL-C to again center the cursor. Press "G" to select the color green.
- 10) Press the "9" key 6 times to move the cursor in an upper-right-hand direction.
- 11) Press "M" for magenta and then the "2" key 25 times to move the cursor downward.
- 12) Press "C" for cyan and then the "4" key 7 times followed by the "6" key 14 times.
- 13) Now press CTRL-F to turn off the blinking cursor and

you should have a large number "1" plotted in several colors on your TV screen.

- 14) This concludes the example. Press "ESC" (escape key) to abort the program and return to CDOS.

This chapter concludes both Part II, the section on the program Dazzleplot, and also the Dazzler Graphics manual. It is hoped that the programs provided in this package and described here will stimulate an interest in graphics software with an emphasis on its serious application. There are many practical uses for graphics--from visual display of real-time control devices to 3-D plotting as an educational and visual aid. The availability of graphics software will become increasingly important as the resolution and color distinction of graphics output devices gets higher. Persons who make interesting or novel application of the programs contained herein are encouraged to share their ideas and input with CROMEMCO.



