CROMEMCO DAZZLER GAMES

Instruction Manual

CROMEMCO, INC.
280 Bernardo Avenue
Mountain View, CA 94040

Part No. 023-0043

September 1978

TABLE OF CONTENTS

CROMEMCO DAZZLER GAMES

Cromemco offers the following computer games on either a 5" diskette (model FDG-S) or 8" diskette (model FDG-L):

CHASE

DAZZLE-DOODLE

DAZZLE-MATION

FOUR-DIMENSIONAL TIC TAC TOE

DOGFIGHT

GOTCHA

KALEIDOSCOPE

LIFE

MAGENTA MARTINI

SPACEWAR

TANKWAR

TRACK

XLIFE

All of these games use the Cromemco Dazzler* interface for your color TV display. The diskettes are designed to be used with Cromemco disk computer systems configured with Z-80 CPU running at 4MHz and with 16K of RAM memory. Several of the games also make use of joystick controls (Cromemco model JS-1)

*Registered trademark of Cromemco

interfaced to the computer using the Cromemco model D+7A analog interface.

After loading the game diskette, you will receive the following response on your display console:

```
CROMEMCO DAZZLER GAMES
A.
```

In response to the CDOS prompt "A." you can type "DIR" to get a complete directory of the Dazzler games on your diskette. You can begin execution of any of these games by simply typing the name of the game exactly as it appears in the directory followed by a carriage return. Since directory names are limited to a maximum of eight characters, several of the names are abbreviated, as can be seen in the directory listing. For example, to run Kaleidoscope you will type:

```
A. KALEIDO
```

To terminate any game simply depress the computer reset switch then depress the carriage return key on your terminal three or four times until you again receive the prompt to select another game:

```
CROMEMCO DAZZLER GAMES
A.
```

This manual contains operating instructions for each of the Dazzler games on your diskette. In addition, source code listings for two of the games (GOTCHA and DAZZLE-DOODLE) are given here as illustrative examples of Dazzler programming technique. The source code for GOTCHA was assembled using

the Cromemco CDOS Z-80 assembler while the source code for DAZZLE-DOODLE was assembled by hand.

Please also note that Appendix A details engineering modifications required for REV B and REV C series Dazzlers to assure compatibility with subsequent Cromemco products.

CHASE!

CHASE! is a two-person competitive game using two Cromemco JS-1 joystick consoles. The game display is generated on a color TV using the Cromemco Dazzler TV interface.

The game begins with a cross and a circle in opposite corners of the playing field. One joystick controls the cross, the other the circle. The object is for the cross to catch the circle. The game score is automatically kept as is the time remaining. The player controlling the cross gains a point every time he catches the circle. When the time for the first half of the game is exhausted, the second half can be entered by depressing button number two on the joystick console. During the second half of the game, the second player now controls the cross and gains points as he catches the circle (now controlled by the first player). At the end of the game, the score of both players is displayed on the screen.

The game is begun by pushing switch number one on the joystick console. The game can be restarted at any time by pushing button number four on the joystick console.

DAZZLE DOODLE

The Cromemco Dazzle-Doodle software is designed to allow the user to draw full-color pictures on the screen of an ordinary color TV under joystick control. The hardware required is a Cromemco JS-1 joystick console, a Cromemco D+7A interface for the joystick console, and a Cromemco TV Dazzler for the TV display interface. When using the Cromemco Dazzler games diskette, simply type "DOODLE" to begin execution of this program.

To use the Dazzle-Doodle program simply depress either button 2, 3, or 4 on the joystick console and begin "drawing" with the joystick. Button 2 is for red, 3 gives green, and button 4 is for blue. More than one of these buttons may be depressed for a combination of colors. Button 1 is used to erase the picture. The screen may also be filled with color by depressing button 1 while at the same time depressing one or more of buttons 2, 3, or 4. A source listing of the program is given below:

Address	Contents	Comments
000 000	303 JMP	Jump to main program (optional
000 001	000	instruction for execution to begin
000 002	002	at zero in memory).
002 000	076 MVI , A	Main program begins here.
001	204	
002	323 OUT	Out to Dazzler to display picture
003	016	from 2K to 4K in memory.
004	076 MVI , A	
005	060	
006	323 OUT	Out to Dazzler for 64X64 mode
007	017	full color.
010	333 IN	Input from JS-1 console switches.
011	030	
012	057 CMA	
013	366 ORI	
014	020	
015	037 RAR	
016	107 MOV B , A	Save in B register state of switches.
017	332 JC	Jump if switch #1 is depressed.

Address	Contents	Comments
002 020	146	
021	002	
022	333 IN	Input joystick x-axis.
023	031	
024	306 ADI	
025	100	
026	362 JP	Jump if voltage within range.
027	033	
030	002	
031	006 MVI B	Otherwise put zeros in B register
032	000	to prevent screen write.
033	037 RAR	
034	137 MOV E , A	Put X displacement in E.
035	333 IN	Input joystick y-axis.
036	032	
037	306 ADI	
040	100	
041	362 JP	Jump if voltage within range.
042	046	
043	002	
044	006 MVI B	Otherwise put zeros in B register
045	000	to prevent screen write.
046	037 RAR	
047	057 CMA	
050	127 MOV D , A	Put Y displacement in D register.
051	000 NOP	
052	000 NOP	
053	000 NOP	
054	346 ANI	The following instructions are used
055	077	to generate a 64X64 Dazzler address
056	147 MOV H , A	in HL given that the X,Y coordinates
057	346 ANI	are in DE.
060	040	
061	204 ADD H	
062	147 MOV H , A	
063	173 MOV A , E	
064	346 ANI	
065	040	
066	264 ORA H	
067	017 RRC	
070	017 RRC	
071	017 RRC	
072	017 RRC	
073	147 MOV H , A	
074	173 MOV A , E	
075	017 RRC	
076	346 ANI	
077	017	
100	157 MOV L , A	
101	174 MOV A , H	
102	346 ANI	
103	360	
104	265 ORA L	
105	157 MOV L , A	
106	174 MOV A , H	

Address	Contents	Comments
002 107	346 ANI	
110	007	
111	366 ORI	This sets the addresses of picture
112	010	between 2K and 4K in memory.
113	147 MOV H , A	
114	116 MOV C , M	Fetch data byte from memory.
115	173 MOV A , E	
116	017 RRC	Put LSB of X in carry.
117	332 JC	Jump to write in upper nybble
120	132	of data byte.
121	002	
122	076 MVI A	
123	017	
124	240 ANA B	Strip color information from B.
125	261 ORA C	OR with present memory data.
126	167 MOV M , A	Replace with new memory data.
127	303 JMP	Jump back to the beginning.
130	004	
131	002	
132	076 MVI A	
133	017	
134	240 ANA B	Strip color information from B.
135	007 RLC	Shift into upper half of byte.
136	007 RLC	
137	007 RLC	
140	007 RLC	
141	261 ORA C	OR with present memory data.
142	167 MOV M , A	Replace with new memory data.
143	303 JMP	Jump back to the beginning.
144	004	
145	002	
146	041 LXI H	Start of memory clear routine.
147	000	Address of first byte
150	010	of Dazzler picture.
151	076 MVI A	
152	017	
153	240 ANA B	Strip color from B.
154	117 MOV C , A	
155	007 RLC	Copy in upper half of byte.
156	007 RLC	
157	007 RLC	
160	007 RLC	
161	261 ORA C	
162	117 MOV C , A	
163	161 MOV M , C	Store new data in memory.
164	043 INX H	Increment memory location.
165	174 MOV A , H	
166	376 CPI	Check to see if at 4K.
167	020	
170	322 JNC	Jump if through.
171	004	
172	002	
173	303 JMP	Otherwise loop for new location.
174	163	
175	002	

DAZZLE-MATION

General Description

The Dazzlemation program, written by Steve Dompier, is designed as an aid in the production of animated DAZZLER displays. The "Magenta Martini" animation is provided as one example of the type of animation possible using the Dazzlemation program.

Once the Dazzlemation program is entered into your computer, the animation sequence can be entered from your keyboard or paper tape reader. CONTROL R on your keyboard is the command to begin the display of the animated sequence.

Composing an Animation Sequence

Animation sequences are composed using your keyboard. First you should be familiar with these Dazzlemation Executive Commands:

CONTROL Q - Begin a new sequence.
CONTROL B - Stop cursor from flashing.
CONTROL C - Delete cursor.
CONTROL R - Run.
CONTROL X - Stop and return to executive.

After depressing CONTROL Q on your keyboard to begin a new sequence, the sequence is drawn on your TV screen using keyboard entries. As you deposit the sequence, the direction of cursor motion is first set by these commands:

N - Up
M - Down
COMMA - Left
PERIOD - Right

For diagonal moves, hold down the SHIFT key while depressing N or M and then COMMA or PERIOD.

To set the intensity of each point as you deposit it in sequence use one of these two commands:

H - High intensity
L - Low intensity

Now you are ready to enter the animation sequence. The color of each point entered in the sequence is determined by which key is used to deposit that element:

R - Red
G - Green
Y - Yellow
W - White
B - Blue
P - Purple
C - Cyan
RUBOUT - Black
\+ - Pause

The following commands may be inserted in a program sequence:

CONTROL Z Clear screen, maintain trace memory when the screen is rewritten.

ESCAPE Clear screen, inhibit trace memory.

CONTROL S Programmed stop point.

For teletypes CONTROL - SHIFT K provides the ESCAPE function. For most other terminals, it is CONTROL SEMI - COLON.

After the Dazzlemation sequence is deposited from the keyboard, the cursor should be positioned at the point relative to the original drawing where the original sequence should be redrawn in the animation. To start the animation depress CONTROL R. As long as there is no CONTROL S in the sequence, the sequence will be redrawn on the screen again and again, the speed of execution being set by the sense switches. Eash subsequent drawing in the animation will be displaced from the previous one precisely by the same amount the cursor was displaced from the original drawing at the time of execution. Note that CONTROL R clears CONTROL S, so should you want just a single execution of your sequence, CONTROL S must be set for each execution.

Once you have composed a Dazzlemation animation you may wish to save the animation on paper tape. The special Dazzlemation command SHIFT P can be used to punch your Dazzlemation sequence on paper tape. When using the SHIFT P command, be sure that a CONTROL S is used to terminate your sequence.

DOGFIGHT

The game of "Dogfight" is a two-player game using two Cromemco JS-1 joystick modules. Each player uses a joystick and four joystick pushbuttons to control his fighter plane on the Dazzler display.

The airplane's throttle is controlled by buttons 3 and 4 on the joystick console. Push both buttons 3 and 4 for maximum thrust. The joystick is the airplane's elevator control. Once flying speed is attained (by holding down buttons 3 and 4) pull back on the joystick to become airborn. An aeleron roll can be achieved by depressing buttons 2 on the joystick console. Machine gun fire is initiated by pressing button number 1.

The purpose of the game is to shoot the opponent out of the sky. You gain a point every time that a hit is scored. The dynamics of flight are carefully simulated in this game so that you must maintain flying speed to stay aloft.

The first player to gain 21 points is the winner of the game. At this point the game can be restarted by pressing all four buttons on each joystick console.

FOUR DIMENSIONAL TIC-TAC-TOE

Four dimensional tic-tac-toe is a logical extension of the familiar two dimensional tic-tac-toe. Once the basic concept of converting four dimensions into two is grasped, the game is easy to play.

Imagine first a four square by four square (16 squares) playing board. Stack three identical boards on top of the first such that each square on a board is the bottom of a cube. This is a three dimensional tic-tac-toe board, a cube composed of 64 small cubes. Any sequence of four cubes that spans the cube from one surface to another in a straight line is a winning combination. To visualize these combinations more easily, imagine that instead of four horizontal boards, there were four vertical boards, or two boards (slightly stretched) placed between the edges of the cube, forming an "X". All sequences of squares that are winning combinations on the boards in two dimensions are also winning combinations in three dimensions. There are no other winning combinations in three dimensional tic-tac-toe. The same can be tried in two dimensions, using a one dimensional board to find the winning combination.

Before proceeding to four dimensions, the three dimensional playing board must be represented in two dimensions. This is simple to do by unstacking the four two dimensional boards which compose the three dimentional board, and lying them top to bottom in a column. Instead of trying to visualize a four dimensional tic-tac-toe board, it is much easier to convert it into three dimensions. A four dimensional board becomes four three dimensional boards side by side in a row. The three dimensional

representation can be compressed into two dimensions by unstacking the four two dimensional boards each three dimensional board is composed of, and placing them in columns. That leaves sixteen boards arranged four by four, each of which contains sixteen squares arranged four by four.

To find all the combinations use the two dimensional representation of a three dimensional board (four two dimensional boards in a column). Superimpose it on the four rows, four columns, and (with each board turned 45^{o}) the two diagonals of two dimensional boards which make up the four dimensional board. Each sequence of four squares that corresponds to a winning combination on the superimposed three dimensional board is also a winning combination in four dimensional tic-tac-toe. There are no other winning combinations.

The four dimensional board represented in two dimensions looks like a big two dimensional board whose squares are smaller two dimensional boards. The similarity is very useful. Each small board has ten winning combinations. Each combination can be represented by a sequence of four squares. The sequence can be given in two different directions. The same combinations can be used to specify a sequence of small boards within the big board. Two sequences, specifying a board and a square within that board are combined to specify a sequence of four squares in four dimensions.

Using the winning combinations of two dimensional tic-tac-toe, specified by sequences of squares in both directions, any two sequences may be combined to give a winning combination in four dimensional tic-tac-toe. In addition to these combinations, each board is a tic-tac-toe game in itself, and the square's position can remain constant while the boards follow some winning sequence.

How to Play the Game

The four dimensional tic-tac-toe program is a game in which one person plays against the computer. The player makes his move by selecting the number which corresponds to the square he wishes to occupy. The computer will show this move on a color television display controlled by a Cromemco Dazzler. The computer then makes its move, which is shown on the television display.

The first 1.75K of memory contains the program. The next .25K of memory is reserved for the program stack. The display is located from 2K to 2.5K (this must be static RAM). A .5K workspace fills the rest of the 3K. All of the non-program memory must be RAM.

The program starts from location 0000. When started, it disables the interrupt system, and turns on the Dazzler display. It then asks if it can play first. If a "Y" is typed, the computer will make the first move. If any other character is typed, then the player may make the first move. A playing board is then constructed on the display, and the computer is ready to accept the player's move. If the computer made the first move, that move will be displayed. The computer will then accept the player's move.

The player enters his move by entering from a ASCII keyboard the number of the square he wishes to take (see Figure 1). The computer will make sure the square has not been taken. The computer is then ready to accept another input. If the square is unoccupied, the square's number is output to the lights and is marked in yellow on the display. If the player is unsatisfied with his move, he may type a space. The computer will extinguish the yellow square, and wait for another move to be input. If the player is satisfied with his move, he may type a return and the

computer will change the yellow square to the player's color. The computer will then make its move. When that move appears on the screen and on the lights, the computer is ready to accept the player's next move. If the move appears in white, the game is a tie, and the program jumps to the beginning.

If the computer discovers that the player has four squares in a row, it will turn the winning squares green and jump to the beginning of the program. If the computer finds that it will have four in a row after it makes its move, it turns the possible winning squares yellow. If the player does not also have four squares in a row, the computer will turn the yellow squares white, output the winning square's number to the lights, and jump to the beginning of the program. If the player does have four in a row, the computer will turn those squares green and jump to the beginning of the program.

How the Program Operates

The computer makes its moves by examining each winning combination of four squares. The computer determines which of nine categories each combination fits into. The nine categories are: all the squares empty; one, two, three, or four squares occupied by the player and the rest empty; one, two, or three squares occupied by the player and the rest empty; or some squares occupied by the player and some by the computer. In the later case, the computer does nothing and continues on to the next combination. In the cases where zero, one, or two squares are occupied, the computer uses two words of memory corresponding to each square. This forms a sixteen bit word for each square. If all the squares are empty, then, for each square, the computer adds one to the

least significant word in memory corresponding to the empty square. If the computer or the player occupies one square, and the rest are empty, then for each square the computer adds one to the most significant word in memory which corresponds to the empty square. If the player has two squares, the computer adds 10H to the most significant words in memory corresponding to the two empty squares. The computer will not add more than 30H to any one square. If the computer has two squares, it adds 40H to the most significant words corresponding to the two empty squares. The computer will not add more than OCOH to any one square.

In the cases where three squares are occupied, the computer remembers which square was empty. If the player has three squares, then the computer must block him by taking the empty square. If the computer has three squares, then it will remember the empty square it needs to win, and forget about blocking. It will turn all four squares yellow, and continue on to see if the player has won.

If the player has four squares in a row, then the computer stops looking at winning combinations. It will turn the winning squares green and jump to the beginning of the program.

After all winning combinations have been looked at, the computer must decide which square it wants to take. If the player has won, the computer will not reach this point. It first checks to see if it has already chosen a winning square. If it has, it will output that square on the lights, change the yellow squares to red, and jump to the beginning of the program. If it has chosen a blocking square, it will output that square to the lights and display and wait for the player's next move.

If no square has already been chosen, the computer must look at the words of memory which correspond to the squares. The computer will pick the square whose two words of memory contain the greatest sixteen bit value. The selected square is output on the lights and display, and the computer waits for the player's move. If the game turns out to be a tie, the computer will output its move in red and jump to the beginning of the program.

Note- In addition to a Cromemco Dazzler to generate the color TV display, a CRT terminal or Teletype is required to play 4D TIC TAC TOE. Messages from the computer appear on the teletype or CRT display while the keyboard is used for input.

THE BOARD

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F
80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F
A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF
B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF
C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DA	DB	DC	DD	DE	DF
E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	EA	EB	EC	ED	EE	EF
F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	FA	FB	FC	FD	FE	FF

Fig. 1

GOTCHA!

GOTCHA! pits you against your opponent on a colorful game in which you try to occupy the playing field while blocking your opponent's access.

RED starts in the upper left hand corner of the board; BLUE in the lower right. At START, RED begins travelling downward, leaving a solid red line, and BLUE travels upward, leaving a blue line. Direction is altered by the Cromemco Joystick controls. If a player hits a boundary, himself, or the other player's line, his opponent scores a point. The game continues until nine points have been scored by one player. Pushbutton 1 starts the game and pushbutton 3 resets it to zero.

Pushbutton 2 speeds up the progress of the lines and can be used strategically against your opponent.

A source listing of the GOTCHA! program is given on the following pages.

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

                        0002 ;
                        0003 ;THIS IS THE EXCITING GAME OF GOTCHA !!!!1!!
                        0004 ;
0000                    0005            ORG     0
0000 F3                 0006 START:     DI
0001 315B03             0007            LD      SP,STACK
0004 CDBE00             0008            CALL    INIT            ;INIT PROGRAM
0007 CDFB02             0009            CALL    WBONE           ;WAIT FOR BUTTON ONE
000A 2A1403             0010 MAIN:      LD      HL,(POS1)       ;POSITION, PLAYER 1
000D EB                 0011            EX      DE,HL           ;PUT IN DE
000E 3E09               0012            LD      A,P1COLR        ;COLOR, PLAYER 1
0010 321A03             0013            LD      (NCOLOR),A
0013 3A1803             0014            LD      A,(DIR1)        ;DIRECTION, PLAYER 1
0016 CD1602             0015            CALL    MOVDOT          ;MAKE MOVE
0019 EB                 0016            EX      DE,HL
001A 221403             0017            LD      (POS1),HL       ;STORE NEW XY
001D EB                 0018            EX      DE,HL
001E 010000             0019            LD      BC,0            ;INIT FLAGS
0021 CA2D00             0020            JP      Z,MAN300        ;CAN MOVE
0024 C5                 0021            PUSH    BC              ;SAVE BC
0025 3E0F               0022            LD      A,15            ;PAINT DOT WHITE
0027 CDCB01             0023            CALL    PUTCOL
002A C1                 0024            POP     BC              ;RESTORE BC
002B 0601               0025            LD      B,1             ;SAY CAN'T MOVE
002D C5                 0026 MAN300:    PUSH    BC              ;SAVE FLAGS
002E 2A1603             0027            LD      HL,(POS2)       ;POSITION, PLAYER 2
0031 EB                 0028            EX      DE,HL           ;PUT IN DE
0032 3E0C               0029            LD      A,P2COLR        ;COLOR, PLAYER 2
0034 321A03             0030            LD      (NCOLOR),A
0037 3A1903             0031            LD      A,(DIR2)        ;DIRECTION, PLAYER 2
003A CD1602             0032            CALL    MOVDOT          ;MAKE MOVE
003D EB                 0033            EX      DE,HL
003E 221603             0034            LD      (POS2),HL       ;SAVE NEW XY
0041 EB                 0035            EX      DE,HL
0042 C1                 0036            POP     BC
0043 CA4F00             0037            JP      Z,MAN320        ;CAN MOVE
0046 C5                 0038            PUSH    BC              ;SAVE BC
0047 3E0F               0039            LD      A,15            ;PAINT DOT WHITE
0049 CDCB01             0040            CALL    PUTCOL
004C C1                 0041            POP     BC              ;RESTORE BC
004D 0E01               0042            LD      C,1             ;SAY CAN'T MOVE
004F 78                 0043 MAN320:    LD      A,B             ;GET 1ST FLAG
0050 A7                 0044            AND     A
0051 C26900             0045            JP      NZ,MAN400       ;PLAYER 1 HIT
0054 79                 0046            LD      A,C
0055 A7                 0047            AND     A
0056 CA9A00             0048            JP      Z,MAN600        ;NOBODY HIT
0059 CDA600             0049            CALL    CPOS            ;CHECK IF RAN INTO EACH
005C CA7B00             0050            JP      Z,MAN450        ;YES
005F 211203             0051            LD      HL,NUM1         ;PT TO SCORE 1
0062 34                 0052            INC     (HL)
0063 CD0401             0053            CALL    DPLAY1          ;DISPLAY NEW SCORE
```

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

0066 C37B00          0054            JP      MAN450
                     0055 ;
0069 79              0056 MAN400:    LD      A,C             ;GET 2ND FLAG
006A A7              0057            AND     A
006B C27B00          0058            JP      NZ,MAN450       ;BOTH HIT
006E CDA600          0059            CALL    CPOS            ;Q, RAN INTO EACH OTHER
0071 CA7B00          0060            JP      Z,MAN450        ;YES
0074 211303          0061            LD      HL,NUM2         ;PT TO SCORE 2
0077 34              0062            INC     (HL)
0078 CDF600          0063            CALL    DPLAY2          ;DISPLAY NEW SCORE
007B CDB300          0064 MAN450:    CALL    SONG            ;PLAY A SONG
007E 3A1203          0065 MAN500:    LD      A,(NUM1)        ;GET SCORE 1
0081 FE09            0066            CP      9
0083 CA8E00          0067            JP      Z,ENDRND        ;END OF ROUND
0086 3A1303          0068            LD      A,(NUM2)        ;GET SCORE 2
0089 FE09            0069            CP      9
008B C29400          0070            JP      NZ,MAN550       ;NOT END OF ROUND
008E CDFB02          0071 ENDRND:    CALL    WBONE           ;WAIT FOR BUTTON 1
0091 CDBE00          0072            CALL    INIT            ;RE-INIT PROGRAM
0094 CDD100          0073 MAN550:    CALL    DAZWRT          ;REWRITE SCREEN
0097 C30A00          0074            JP      MAIN            ;LOOP
                     0075 ;
009A CDD202          0076 MAN600:    CALL    WAIT            ;WAIT A WHILE
009D CD3C02          0077            CALL    GNEW1           ;GET NEW DIRECTIONS
00A0 CD5502          0078            CALL    GNEW2
00A3 C30A00          0079            JP      MAIN
                     0080 ;
                     0081 ;COMPARE BOTH POSITIONS
                     0082 ;OUTPUT - Z SET IF EQUAL
                     0083 ;
00A6 2A1403          0084 CPOS:      LD      HL,(POS1)       ;POSITION, PLAYER 1
00A9 EB              0085            EX      DE,HL
00AA 2A1603          0086            LD      HL,(POS2)       ;POSITION, PLAYER 2
00AD 7A              0087            LD      A,D
00AE BC              0088            CP      H
00AF C0              0089            RET     NZ              ;NOT EQUAL
00B0 7B              0090            LD      A,E
00B1 BD              0091            CP      L
00B2 C9              0092            RET
                     0093 ;
                     0094 ;PLAY A SONG
                     0095 ;
00B3 21B900          0096 SONG:      LD      HL,SON090
00B6 C3AE02          0097            JP      NOTES
                     0098 ;
00B9 40              0099 SON090:    DB      40H             ;VOLUME
00BA 78              0100            DB      120             ;FREQ. PARM
00BB F401            0101            DW      500             ;DURATION
00BD 00              0102            DB      0               ;END OF TABLE
                     0103 ;
                     0104 ;INITIALIZE PROGRAM
                     0105 ;
```

```
00BE 3E90          0106 INIT:   LD      A,090H
00C0 D30F          0107         OUT     15,A
00C2 3E82          0108         LD      A,[DISPLY SHR 9]+80H
00C4 D30E          0109         OUT     14,A
00C6 3E00          0110         LD      A,0
00C8 321203        0111         LD      (NUM1),A        ;INIT SCORE
00CB 321303        0112         LD      (NUM2),A
00CE CDFD01        0113         CALL    INTJOY          ;INIT JOY STICKS
                   0114 ;
                   0115 ;WRITE DAZZLER DISPLAY
                   0116 ;
00D1 210903        0117 DAZWRT: LD      HL,309H
00D4 221403        0118         LD      (POS1),HL       ;INIT POSITION FOR PLAYER
00D7 211C1C        0119         LD      HL,1C1CH
00DA 221603        0120         LD      (POS2),HL       ;INIT POSITION FOR PLAYER
00DD 3E02          0121         LD      A,2             ;DIRECTION 1 = DOWN
00DF 321803        0122         LD      (DIR1),A
00E2 3E01          0123         LD      A,1             ;DIRECTION 2 = UP
00E4 321903        0124         LD      (DIR2),A
00E7 210004        0125         LD      HL,DISPLY       ;PT TO DISPLAY
00EA 010002        0126         LD      BC,200H         ;LENGTH
00ED CDEE01        0127         CALL    CLEAR           ;CLEAR DISPLAY AREA
00F0 CD6D01        0128         CALL    BOARD           ;DISPLAY BOARDER
00F3 CD0401        0129         CALL    DPLAY1          ;DISPLAY 1ST SCORE
                   0130 ;
                   0131 ;DISPLAY 2ND SCORE
                   0132 ;
00F6 11001C        0133 DPLAY2: LD      DE,28*256               ;PT TO POSITION
00F9 3E0C          0134         LD      A,P2COLR        ;GET COLOR
00FB 321A03        0135         LD      (NCOLOR),A
00FE 3A1303        0136         LD      A,(NUM2)        ;GET SCORE
0101 C30F01        0137         JP      DSPNUM          ;DISPLAY NUMBER
                   0138 ;
                   0139 ;DISPLAY 1ST SCORE
                   0140 ;
0104 110001        0141 DPLAY1: LD      DE,100H         ;PT TO POSITION
0107 3E09          0142         LD      A,P1COLR        ;GET COLOR
0109 321A03        0143         LD      (NCOLOR),A
010C 3A1203        0144         LD      A,(NUM1)        ;GET SCORE
                   0145 ;
                   0146 ;DISPLAY 3X5 DIGIT ON DAZZLER
                   0147 ;INPUT - DE CONTAINS TOP,LEFT X,Y FOR NUMBER
                   0148 ;        A CONTAINS NUMBER
                   0149 ;
010F 213D01        0150 DSPNUM: LD      HL,DNMTAB       ;PT TO DIGIT TABLE
0112 E60F          0151         AND     15
0114 47            0152         LD      B,A
0115 87            0153         ADD     A
0116 80            0154         ADD     B
0117 CDF801        0155         CALL    ADDAHL          ;PT TO CORRECT NUMBER
011A 0E03          0156         LD      C,3             ;COUNTER
011C 0605          0157 DNM300: LD      B,5             ;COUNTER
```

```
011E 7E          0158           LD      A,(HL)          ;GET BYTE FROM TABLE
011F 17          0159 DNM320:   RLA                     ;GET 1ST BIT
0120 F5          0160           PUSH    AF              ;SAVE AF
0121 3A1A03      0161           LD      A,(NCOLOR)      ;GET COLOR FOR NUMBER
0124 DA2801      0162           JP      C,DNM350        ;DO PUT COLOR THERE
0127 97          0163           SUB     A               ;DO NOT PUT COLOR THERE
0128 CDCB01      0164 DNM350:   CALL    PUTCOL          ;PUT COLOR
012B F1          0165           POP     AF              ;RESTORE AF
012C 1C          0166           INC     E               ;INC Y POSITION
012D 05          0167           DEC     B               ;COUNT DOWN
012E C21F01      0168           JP      NZ,DNM320       ;LOOP
0131 1D          0169           DEC     E
0132 1D          0170           DEC     E
0133 1D          0171           DEC     E
0134 1D          0172           DEC     E
0135 1D          0173           DEC     E
0136 14          0174           INC     D               ;INC X POSITION
0137 23          0175           INC     HL              ;PT TO NEXT BYTE
0138 0D          0176           DEC     C               ;COUNT DOWN
0139 C21C01      0177           JP      NZ,DNM300       ;LOOP
013C C9          0178           RET
                 0179 ;
013D F888F8      0180 DNMTAB:   DB      0F8H,088H,0F8H  ;ZERO
0140 0000F8      0181           DB      000H,000H,0F8H  ;ONE
0143 B8A8E8      0182           DB      0B8H,0A8H,0E8H  ;TWO
0146 A8A8F8      0183           DB      0A8H,0A8H,0F8H  ;THREE
0149 E020F8      0184           DB      0E0H,020H,0F8H  ;FOUR
014C E8A8B8      0185           DB      0E8H,0A8H,0B8H  ;FIVE
014F F8A8B8      0186           DB      0F8H,0A8H,0B8H  ;SIX
0152 8080F8      0187           DB      080H,080H,0F8H  ;SEVEN
0155 F8A8F8      0188           DB      0F8H,0A8H,0F8H  ;EIGTH
0158 E0A0F8      0189           DB      0E0H,0A0H,0F8H  ;NINE
015B F8A0F8      0190           DB      0F8H,0A0H,0F8H  ;A
015E F82838      0191           DB      0F8H,028H,038H  ;B
0161 F88888      0192           DB      0F8H,088H,088H  ;C
0164 3828F8      0193           DB      038H,028H,0F8H  ;D
0167 F8A8A8      0194           DB      0F8H,0A8H,0A8H  ;E
016A F8A0A0      0195           DB      0F8H,0A0H,0A0H  ;F
                 0196 ;
                 0197 ;DISPLAY BOARDER
                 0198 ;
016D 110600      0199 BOARD:    LD      DE,6            ;START OF BOARDER
0170 0620        0200           LD      B,32            ;LENGTH OF BOARDER
0172 3E0A        0201 BRD300:   LD      A,BCOLOR        ;COLOR OF BOARDER
0174 CDCB01      0202           CALL    PUTCOL          ;PUT COLOR
0177 14          0203           INC     D               ;INC X PTR
0178 05          0204           DEC     B               ;COUNT DOWN
0179 C27201      0205           JP      NZ,BRD300       ;LOOP UNTIL DONE
017C 111F00      0206           LD      DE,31
017F 0620        0207           LD      B,32            ;LENGTH
0181 3E0A        0208 BRD320:   LD      A,BCOLOR        ;COLOR OF BOARDER
0183 CDCB01      0209           CALL    PUTCOL          ;PUT COLOR
```

```
0186 14          0210           INC     D               ;INC X PTR
0187 05          0211           DEC     B               ;COUNT DOWN
0188 C28101      0212           JP      NZ,BRD320       ;LOOP UNTIL DONE
018B 110700      0213           LD      DE,7
018E 0618        0214           LD      B,24            ;LENGTH
0190 3E0A        0215 BRD340:   LD      A,BCOLOR        ;COLOR OF BOARDER
0192 CDCB01      0216           CALL    PUTCOL          ;PUT COLOR
0195 1C          0217           INC     E               ;INC Y PTR
0196 05          0218           DEC     B               ;COUNT DOWN
0197 C29001      0219           JP      NZ,BRD340       ;LOOP UNTIL THRU
019A 11071F      0220           LD      DE,1F07H
019D 0618        0221           LD      B,24            ;LENGTH
019F 3E0A        0222 BRD360:   LD      A,BCOLOR        ;COLOR OF BOARDER
01A1 CDCB01      0223           CALL    PUTCOL          ;PUT COLOR
01A4 1C          0224           INC     E               ;INC Y PTR
01A5 05          0225           DEC     B               ;COUNT DOWN
01A6 C29F01      0226           JP      NZ,BRD360       ;LOOP
01A9 C9          0227           RET
                 0228 ;
                 0229 ;POINT TO DOT
                 0230 ;INPUT - DE CONTAINS XY
                 0231 ;OUTPUT - HL PTS TO NIBBLE
                 0232 ;           CARRY SET IF TOP NIBBLE
                 0233 ;
01AA 6B          0234 DOTPTR:   LD      L,E             ;GET Y POSITION
01AB 2600        0235           LD      H,0
01AD 29          0236           ADD     HL,HL           ;MULTIPLY BY 16
01AE 29          0237           ADD     HL,HL
01AF 29          0238           ADD     HL,HL
01B0 29          0239           ADD     HL,HL
01B1 7A          0240           LD      A,D             ;GET X POSITION
01B2 1F          0241           RRA                     ;DIVIDE BY 2
01B3 F5          0242           PUSH    AF              ;SAVE CARRY
01B4 CDF801      0243           CALL    ADDAHL          ;ADD TO HL
01B7 010004      0244           LD      BC,DISPLY       ;PT TO DISPLAY
01BA 09          0245           ADD     HL,BC           ;PT TO CORRECT DOT
01BB F1          0246           POP     AF              ;RESTORE CARRY
01BC C9          0247           RET
                 0248 ;
                 0249 ;GET DOT
                 0250 ;INPUT - DE CONTAINS XY
                 0251 ;OUTPUT - A CONTAINS COLOR
                 0252 ;
01BD CDAA01      0253 GETCOL:   CALL    DOTPTR          ;PT TO NIBBLE
01C0 7E          0254           LD      A,(HL)          ;GET BYTE
01C1 D2C801      0255           JP      NC,GCL300       ;BOTTOM NIBBLE
01C4 1F          0256           RRA                     ;GET TOP NIBBLE
01C5 1F          0257           RRA
01C6 1F          0258           RRA
01C7 1F          0259           RRA
01C8 E60F        0260 GCL300:   AND     15
01CA C9          0261           RET
```

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

                        0262 ;
                        0263 ;PUT COLOR
                        0264 ;INPUT - A CONTAINS COLOR
                        0265 ;         DE CONTAINS X,Y POSITION
                        0266 ;
01CB E5                 0267 PUTCOL:  PUSH    HL              ;SAVE REGISTERS
01CC C5                 0268          PUSH    BC
01CD F5                 0269          PUSH    AF              ;SAVE COLOR
01CE CDAA01             0270          CALL    DOTPTR          ;PT TO NIBBLE
01D1 C1                 0271          POP     BC              ;GET COLOR
01D2 78                 0272          LD      A,B             ;MOVE COLOR TO A
01D3 D2E301             0273          JP      NC,PTC400       ;BOTTOM NIBBLE
01D6 17                 0274          RLA                     ;TOP NIBBLE
01D7 17                 0275          RLA
01D8 17                 0276          RLA
01D9 17                 0277          RLA
01DA E6F0               0278          AND     0F0H            ;AND OFF BOTTOM NIBBLE
01DC 47                 0279          LD      B,A             ;SAVE
01DD 7E                 0280          LD      A,(HL)          ;GET DAZZLER BYTE
01DE E60F               0281          AND     15              ;AND OFF TOP NIBBLE
01E0 C3E901             0282          JP      PTC900
                        0283 ;
01E3 E60F               0284 PTC400:  AND     15              ;AND OFF TOP NIBBLE
01E5 47                 0285          LD      B,A             ;SAVE
01E6 7E                 0286          LD      A,(HL)          ;GET DAZZLER BYTE
01E7 E6F0               0287          AND     0F0H            ;AND OFF BOTTOM NIBBLE
01E9 B0                 0288 PTC900:  OR      B               ;COMBINE NIBBLES
01EA 77                 0289          LD      (HL),A          ;PUT IN DISPLAY
01EB C1                 0290          POP     BC              ;RESTORE REGISTERS
01EC E1                 0291          POP     HL
01ED C9                 0292          RET
                        0293 ;
                        0294 ;CLEAR AREA WITH ZERO'S
                        0295 ;INPUT - HL PT TO AREA
                        0296 ;         BC CONTAIN LENGTH
                        0297 ;
01EE 78                 0298 CLEAR:   LD      A,B
01EF B1                 0299          OR      C
01F0 C8                 0300          RET     Z               ;LENGTH = 0
01F1 97                 0301          SUB     A               ;CLEAR A
01F2 77                 0302          LD      (HL),A          ;CLEAR BYTE
01F3 23                 0303          INC     HL              ;PT TO NEXT BYTE
01F4 0B                 0304          DEC     BC              ;COUNT DOWN
01F5 C3EE01             0305          JP      CLEAR           ;LOOP
                        0306 ;
                        0307 ;ADD A TO HL
                        0308 ;
01F8 85                 0309 ADDAHL:  ADD     L
01F9 6F                 0310          LD      L,A
01FA D0                 0311          RET     NC
01FB 24                 0312          INC     H
01FC C9                 0313          RET
```

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!
```

```
                        0314 ;
                        0315 ;INITIALIZE JOY STICKS
                        0316 ;
01FD DB1A               0317 INTJOY:  IN      A,JOY1UD        ;GET UP/DOWN JOY STICK 1
01FF 2F                 0318          CPL
0200 320E03             0319          LD      (AJ1UD),A       ;ADJUSTMENT
0203 DB19               0320          IN      A,JOY1RL        ;GET RIGHT/LEFT JOY STICK
0205 2F                 0321          CPL
0206 320F03             0322          LD      (AJ1RL),A       ;ADJUSTMENT
0209 DB1C               0323          IN      A,JOY2UD        ;GET UP/DOWN JOY STICK 2
020B 2F                 0324          CPL
020C 321003             0325          LD      (AJ2UD),A       ;ADJUSTMENT
020F DB1B               0326          IN      A,JOY2RL        ;GET RIGHT/LEFT JOY STICK
0211 2F                 0327          CPL
0212 321103             0328          LD      (AJ2RL),A       ;ADJUSTMENT
0215 C9                 0329          RET
                        0330 ;
                        0331 ;MOVE DOT FOR PLAYER
                        0332 ;INPUT - DE CONTAINS XY FOR CURRENT POSITION
                        0333 ;         A CONTAINS DIRECTION TO MOVE
                        0334 ;         NCOLOR CONTAINS PLAYER'S COLOR
                        0335 ;OUTPUT - DE CONTAINS NEW XY
                        0336 ;          Z SET IF CAN MOVE
                        0337 ;
0216 3D                 0338 MOVDOT:  DEC     A
0217 CA2602             0339          JP      Z,MDT300        ;MOVE UP
021A 3D                 0340          DEC     A
021B CA2A02             0341          JP      Z,MDT320        ;MOVE DOWN
021E 3D                 0342          DEC     A
021F CA2E02             0343          JP      Z,MDT340        ;MOVE RIGHT
0222                    0344                                  ;MOVE LEFT
0222 15                 0345          DEC     D               ;MOVE X POSITION LEFT
0223 C32F02             0346          JP      MDT400
                        0347 ;
0226 1D                 0348 MDT300:  DEC     E               ;MOVE Y POSITION UP
0227 C32F02             0349          JP      MDT400
                        0350 ;
022A 1C                 0351 MDT320:  INC     E               ;MOVE Y POSITION DOWN
022B C32F02             0352          JP      MDT400
                        0353 ;
022E 14                 0354 MDT340:  INC     D               ;MOVE X POSITION RIGHT
022F CDBD01             0355 MDT400:  CALL    GETCOL          ;GET COLOR
0232 A7                 0356          AND     A
0233 C0                 0357          RET     NZ              ;CAN'T MOVE
0234 3A1A03             0358          LD      A,(NCOLOR)      ;GET COLOR
0237 CDCB01             0359          CALL    PUTCOL          ;PUT COLOR
023A 97                 0360          SUB     A               ;SAY MOVED
023B C9                 0361          RET
                        0362 ;
                        0363 ;GET NEW DIRECTION FOR PLAYER 1
                        0364 ;
023C 3A0E03             0365 GNEW1:   LD      A,(AJ1UD)       ;GET ADJUSTMENT
```

```
023F 47          0366          LD      B,A
0240 DB1A        0367          IN      A,JOY1UD        ;READ JOY STICK UP/DOW
0242 80          0368          ADD     B               ;ADJUST
0243 47          0369          LD      B,A
0244 3A0F03      0370          LD      A,(AJ1RL)       ;GET ADJUSTMENT
0247 4F          0371          LD      C,A
0248 DB19        0372          IN      A,JOY1RL        ;READ RIGHT/LEFT
024A 81          0373          ADD     C               ;ADJUST
024B 4F          0374          LD      C,A
024C CD6E02      0375          CALL    FNDDIR          ;FIND DIRECTION
024F A7          0376          AND     A
0250 C8          0377          RET     Z               ;NO CHANGE
0251 321803      0378          LD      (DIR1),A        ;CHANGE DIRECTION
0254 C9          0379          RET
                 0380 ;
                 0381 ;GET NEW DIRECTION FOR PLAYER 2
                 0382 ;
0255 3A1003      0383 GNEW2:   LD      A,(AJ2UD)       ;GET ADJUSTMENT
0258 47          0384          LD      B,A
0259 DB1C        0385          IN      A,JOY2UD        ;READ UP/DOWN
025B 80          0386          ADD     B               ;ADJUST
025C 47          0387          LD      B,A
025D 3A1103      0388          LD      A,(AJ2RL)       ;GET ADJUSTMENT
0260 4F          0389          LD      C,A
0261 DB1B        0390          IN      A,JOY2RL        ;READ RIGHT/LEFT
0263 81          0391          ADD     C               ;ADJUST
0264 4F          0392          LD      C,A
0265 CD6E02      0393          CALL    FNDDIR          ;FIND DIRECTION
0268 A7          0394          AND     A
0269 C8          0395          RET     Z               ;NO CHANGE
026A 321903      0396          LD      (DIR2),A        ;CHANGE DIRECTION
026D C9          0397          RET
                 0398 ;
                 0399 ;FIND DIRECTION
                 0400 ;INPUT - B CONTAINS UP/DOWN
                 0401 ;          C CONTAINS RIGHT/LEFT
                 0402 ;OUTPUT - A CONTAINS DIRECTION
                 0403 ;
026E 78          0404 FNDDIR:  LD      A,B             ;GET UP/DOWN
026F A7          0405          AND     A
0270 FA7802      0406          JP      M,FDR300        ;DOWN
0273 1601        0407          LD      D,1             ;UPWARD
0275 C37C02      0408          JP      FDR320
                 0409 ;
0278 1602        0410 FDR300:  LD      D,2             ;DOWNWARD
027A 2F          0411          CPL                     ;COMPLIMENT
027B 47          0412          LD      B,A             ;SAVE COMPLIMENT
027C FE40        0413 FDR320:  CP      40H
027E D28302      0414          JP      NC,FDR330       ;LARGE MOVEMENT
0281 1600        0415          LD      D,0             ;NO CHANGE
0283 79          0416 FDR330:  LD      A,C             ;GET RIGHT/LEFT
0284 A7          0417          AND     A
```

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

0285 FA8D02          0418           JP      M,FDR400        ;LEFT
0288 1E03            0419           LD      E,3             ;RIGHT
028A C39102          0420           JP      FDR420
                     0421 ;
028D 1E04            0422 FDR400:   LD      E,4             ;LEFT
028F 2F              0423           CPL                     ;COMPLIMENT
0290 4F              0424           LD      C,A             ;SAVE COMPLIMENT
0291 FE40            0425 FDR420:   CP      40H
0293 D29802          0426           JP      NC,FDR430       ;LARGE MOVEMENT
0296 1E00            0427           LD      E,0             ;NO CHANGE
0298 7A              0428 FDR430:   LD      A,D
0299 93              0429           SUB     E
029A C8              0430           RET     Z               ;NO CHANGE
029B 7A              0431           LD      A,D
029C A7              0432           AND     A
029D CAAA02          0433           JP      Z,FDR500        ;MUST BE RIGHT/LEFT
02A0 7B              0434           LD      A,E
02A1 A7              0435           AND     A
02A2 CAAC02          0436           JP      Z,FDR550        ;MUST BE UP/DOWN
02A5 78              0437           LD      A,B
02A6 B9              0438           CP      C
02A7 DAAA02          0439           JP      C,FDR500        ;MUST BE RIGHT/LEFT
02AA 7B              0440 FDR500:   LD      A,E
02AB C9              0441           RET
                     0442 ;
02AC 7A              0443 FDR550:   LD      A,D
02AD C9              0444           RET
                     0445 ;
                     0446 ;NOTES
                     0447 ;THIS ROUTINE PLAYS THE NOTES POINTED TO BY HL.
                     0448 ;1ST BYTE = VOLUME
                     0449 ;2ND BYTE = FREG. PARM
                     0450 ;3RD BYTE = LOW BYTE OF DURATION
                     0451 ;4TH BYTE = HIGH BYTE OF DURATION
                     0452 ;
02AE 7E              0453 NOTES:    LD      A,(HL)          ;GET VOLUME
02AF A7              0454           AND     A
02B0 C8              0455           RET     Z               ;END OF NOTES
02B1 47              0456           LD      B,A             ;MOVE VOLUME TO B
02B2 23              0457           INC     HL
02B3 4E              0458           LD      C,(HL)          ;GET FREG. PARM
02B4 23              0459           INC     HL
02B5 5E              0460           LD      E,(HL)          ;GET DURATION LOW
02B6 23              0461           INC     HL
02B7 56              0462           LD      D,(HL)          ;GET DURATION HIGH
02B8 23              0463           INC     HL
02B9 CDBF02          0464           CALL    TONE            ;OUTPUT TONE
02BC C3AE02          0465           JP      NOTES
                     0466 ;
                     0467 ;TONE ROUTINE
                     0468 ;INPUT - B CONTAINS VOLUME
                     0469 ;          C CONTAINS FREG. PARM
```

```
CROMEMCO CDOS Z80 ASSEMBLER V. 1. 4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

                    0470 ;          DE CONTAINS DURATION
                    0471 ;
02BF                0472 TONE:
02BF 78             0473 TON200:  LD      A, B              ;GET VOLUME
02C0 2F             0474          CPL                       ;COMPLIMENT
02C1 47             0475          LD      B, A              ;SAVE VOLUME
02C2 D319           0476          OUT     SPEEK1, A         ;OUTPUT TO SPEEKERS
02C4 D31B           0477          OUT     SPEEK2, A
02C6 79             0478          LD      A, C              ;GET FREG. PARM
02C7 3D             0479 TON300:  DEC     A                 ;DEC COUNTER
02C8 C2C702         0480          JP      NZ, TON300        ;WAIT LOOP
02CB 1B             0481          DEC     DE                ;COUNT DOWN
02CC 7A             0482          LD      A, D
02CD B3             0483          OR      E
02CE C2BF02         0484          JP      NZ, TON200        ;NOT THRU
02D1 C9             0485          RET
                    0486 ;
                    0487 ;WAIT A WHILE
                    0488 ;
02D2 DB18           0489 WAIT:    IN      A, 18H            ;READ BUTTONS
02D4 E622           0490          AND     22H               ;LOOK AT BOTH 2'S
02D6 FE22           0491          CP      22H               ;Q, IS EITHER PUSHED
02D8 061E           0492          LD      B, 30             ;SLOW TIME
02DA CADF02         0493          JP      Z, DELAY          ;NONE PUSHED, SLOW TIME
02DD 060F           0494          LD      B, 15             ;FAST TIME
                    0495 ;
                    0496 ;DELAY
                    0497 ;INPUT - B CONTAINS TIME
                    0498 ;
02DF DB0E           0499 DELAY:   IN      A, 14             ;READ DAZZLER
02E1 FE3F           0500          CP      3FH
02E3 C2DF02         0501          JP      NZ, DELAY         ;WAIT FOR END OF FRAME
02E6 DB0E           0502 DLY300:  IN      A, 14             ;READ DAZZLER
02E8 FE3F           0503          CP      3FH
02EA CAE602         0504          JP      Z, DLY300         ;WAIT FOR START OF FRAME
02ED 05             0505          DEC     B
02EE C2DF02         0506          JP      NZ, DELAY         ;DO IT AGAIN
02F1 DB18           0507          IN      A, 18H            ;READ BUTTONS
02F3 E644           0508          AND     44H
02F5 FE44           0509          CP      44H
02F7 C20B03         0510          JP      NZ, ABORT
02FA C9             0511          RET
                    0512 ;
                    0513 ;WAIT FOR BUTTON 1
                    0514 ;*** ABORT IF BUTTON 3 ****
                    0515 ;
02FB DB18           0516 WBONE:   IN      A, 18H            ;READ BUTTON
02FD E611           0517          AND     11H
02FF FE11           0518          CP      11H
0301 C0             0519          RET     NZ                ;BUTTON HIT
0302 DB18           0520          IN      A, 18H            ;READ BUTTONS
0304 E644           0521          AND     44H
```

```
CROMEMCO CDOS Z80 ASSEMBLER V.1.4A
GOTCHA, GOTCHA, GOTCHA !!!!!!!!!!!!!!

0306 FE44          0522          CP      44H
0308 CAFB02        0523          JP      Z,WBONE
030B C30000        0524 ABORT:   JP      0                 ;*** ABORT ***
                   0525 ;
     (001A)        0526 JOY1UD:  EQU     1AH               ;JOY STICK 1 UP/DOWN
     (0019)        0527 JOY1RL:  EQU     19H               ;JOY STICK 1 RIGHT/LEFT
     (001C)        0528 JOY2UD:  EQU     1CH               ;JOY STICK 2 UP/DOWN
     (001B)        0529 JOY2RL:  EQU     1BH               ;JOY STICK 2 RIGHT/LEFT
     (0019)        0530 SPEEK1:  EQU     19H               ;SPEEKER 1
     (001B)        0531 SPEEK2:  EQU     1BH               ;SPEEKER 2
                   0532 ;
030E (0001)        0533 AJ1UD:   DEFS    1                 ;ADJUSTMENT FOR JOY1UD
030F (0001)        0534 AJ1RL:   DEFS    1                 ;ADJUSTMENT FOR JOY1RL
0310 (0001)        0535 AJ2UD:   DEFS    1                 ;ADJUSTMENT FOR JOY2UD
0311 (0001)        0536 AJ2RL:   DEFS    1                 ;ADJUSTMENT FOR JOY2RL
                   0537 ;
0312 (0001)        0538 NUM1:    DEFS    1                 ;PLAYER 1 SCORE
0313 (0001)        0539 NUM2:    DEFS    1                 ;PLAYER 2 SCORE
0314 (0002)        0540 POS1:    DEFS    2                 ;PLAYER 1 POSITION
0316 (0002)        0541 POS2:    DEFS    2                 ;PLAYER 2 POSITION
0318 (0001)        0542 DIR1:    DEFS    1                 ;PLAYER 1 DIRECTION
0319 (0001)        0543 DIR2:    DEFS    1                 ;PLAYER 2 DIRECTION
                   0544 ;
     (000A)        0545 BCOLOR:  EQU     0AH               ;GREEN FOR BOARDER
031A (0001)        0546 NCOLOR:  DEFS    1                 ;COLOR FOR NUMBER
     (0009)        0547 P1COLR:  EQU     09H               ;PLAYER 1 COLOR = RED
     (000C)        0548 P2COLR:  EQU     0CH               ;PLAYER 2 COLOR = BLUE
                   0549 ;
031B (0040)        0550          DEFS    64
     (035B)        0551 STACK:   EQU     $                 ;STACK
                   0552 ;
     (0400)        0553 DISPLY:  EQU     [$-1]/512*512+512
                   0554 ;
035B               0555          END

0000 ERRORS
```

CROMEMCO CROSS REFERENCE LISTING V.1.0 FOR FILE GOTCHA

```
ABORT    0525  0511
ADDAHL   0308  0154 0242
AJ1RL    0535  0321 0369
AJ1UD    0534  0318 0364
AJ2RL    0537  0327 0387
AJ2UD    0536  0324 0382
BCOLOR   0546  0200 0207 0214 0221
BOARD    0198  0127
BRD300   0200  0204
BRD320   0207  0211
BRD340   0214  0218
BRD360   0221  0225
CLEAR    0297  0126 0304
CPOS     0083  0048 0058
DAZWRT   0116  0072
DELAY    0500  0494 0502 0507
DIR1     0543  0013 0121 0377
DIR2     0544  0030 0123 0395
DISPLY   0554  0107 0124 0243
DLY300   0503  0505
DNM300   0156  0176
DNM320   0158  0167
DNM350   0163  0161
DNMTAB   0179  0149
DOTPTR   0233  0252 0269
DPLAY1   0140  0052 0128
DPLAY2   0132  0062
DSPNUM   0149  0136
ENDRND   0070  0066
FDR300   0409  0405
FDR320   0412  0407
FDR330   0415  0413
FDR400   0421  0417
FDR420   0424  0419
FDR430   0427  0425
FDR500   0439  0432 0438
FDR550   0442  0435
FNDDIR   0403  0374 0392
GCL300   0259  0254
GETCOL   0252  0354
GNEW1    0364  0076
GNEW2    0382  0077
INIT     0105  0007 0071
INTJOY   0316  0112
JOY1RL   0528  0319 0371
JOY1UD   0527  0316 0366
JOY2RL   0530  0325 0389
JOY2UD   0529  0322 0384
MAIN     0009  0073 0078
MAN300   0025  0019
MAN320   0042  0036
MAN400   0055  0044
MAN450   0063  0049 0053 0057 0059
```

CROMEMCO CROSS REFERENCE LISTING V.1.0 FOR FILE GOTCHA

```
MAN500   0064
MAN550   0072  0069
MAN600   0075  0047
MDT300   0347  0338
MDT320   0350  0340
MDT340   0353  0342
MDT400   0354  0345 0348 0351
MOVDOT   0337  0014 0031
NCOLOR   0547  0012 0029 0134 0142 0160 0357
NOTES    0452  0096 0464
NUM1     0539  0050 0064 0110 0143
NUM2     0540  0060 0067 0111 0135
P1COLR   0548  0011 0141
P2COLR   0549  0028 0133
POS1     0541  0009 0016 0083 0117
POS2     0542  0026 0033 0085 0119
PTC400   0283  0272
PTC900   0287  0281
PUTCOL   0266  0022 0039 0163 0201 0208 0215 0222 0358
SON090   0098  0095
SONG     0095  0063
SPEEK1   0531  0477
SPEEK2   0532  0478
STACK    0552  0006
START    0005
TON200   0474  0485
TON300   0480  0481
TONE     0473  0463
WAIT     0490  0075
WBONE    0517  0008 0070 0524
```

KALEIDOSCOPE

KALEIDOSCOPE, written by Li-Chen Wang, is surely one of the most colorful Dazzler programs. No keyboard is required, and there are no controls to operate. Just sit back and marvel at what a program only 127 bytes long can do.

KALEIDOSCOPE uses the first 2.5K of memory space. The upper 2K of this area is reserved for the Dazzler picture. The lower 127 bytes are used for the program.

When using KALEIDOSCOPE from the Cromemco Dazzler games diskette, simply type "KALEIDO" to begin program execution.

LIFE

The game of LIFE was first introduced in the October 1970 issue of Scientific American magazine. The game is described in the following issues of Scientific American: October 1970, p. 120; February 1971, p. 112; April 1971, p. 116. The Dazzler-Life program is a truly spectacular full-color interpretation of the interesting and varied game of LIFE.

Operation

Once the LIFE program is loaded into the computer, an initial colony of cells can be drawn on the TV screen using keyboard controls.

C	move cursor
D	deposit data and move cursor
E	erase data and move cursor

The motion of the cursor in the above functions continues in a given direction until that direction is changed by one of the following:

W	move cursor up
Z	move cursor down
A	move cursor to the left
S	move cursor to the right
RETURN	move cursor to the left edge
Q	move cursor home

Note that W, Z, A and S form a diamond-shaped pattern on the keyboard.

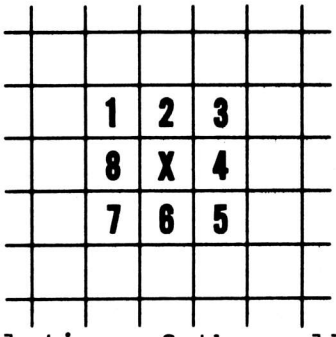
The cursor can be made to move diagonally by using the control key in conjunction with W, Z, A and S.
For example, if control-W is pushed followed by control-S, the cursor will then move diagonally up to the right until changed by further keystrokes.

Once the initial colony is complete, the following keys can be used to control the evolution of the cells.

G	go (starts the evolution)
F	freeze (halts the evolution until the space-bar is pushed)
CONTROL-X	kill the entire colony and start over.

The Game of LIFE

Once the initial colony of cells is drawn on the TV screen using the keyboard commands described above, the keyboard command "G" begins the evolution of the life simulation. The evolution then proceeds according to a fixed set of rules. Each cell in the colony has 8 possible neighbors as shown below:



Each cell has 8 possible neighbors.

The evolution of the cells proceeds in a sequence of distinct generations. Every cell with two or three neighbors will survive to the next generation. Every cell with four or more neighbors dies from over-population. Every empty cell with exactly three neighbors is a birth cell - a new cell is born here in the subsequent generation.

In the Dazzler display of Life, blue cells are used to represent life itself. The birth of a new cell is shown in green, while the death of a cell is shown in red.

There are many surprises to be found in the game. Some colonies survive and prosper; others reach a stable state - neither growing nor lessening. Other colonies are doomed to extinction. Still other colonies, known as "gliders" sail across the screen and can be devoured by other colonies in the process.

XLIFE is a particularly attractive LIFE display that is supplied on your Dazzler game diskette.

SPACEWAR

SPACEWAR is a simulation game for two players. The simulation is performed by a Z-80 or 8Ø8Ø microprocessor equipped with at least the following:

1. 16K RAM Memory
2. A CROMEMCO DAZZLER TV interface (including a TV)
3. A CROMEMCO D+7A analog/digital board
4. A pair of CROMEMCO JS-1 joysticks

The program simulates a portion of an imaginary universe. Within this portion of space, the two combatants' spaceships travel around a central sun and are attracted to it by gravity. The spaceships have distinct profiles so that they can be distinguished.

Each joystick console controls one ship. The object of the game is to blow up your opponent's ship with a torpedo, while your ship remains intact.

The joystick controls the acceleration and the aspect of the ship. Move the stick slightly forward to activate the ship's thruster. The ship will accelerate in the direction it is pointed as long as the stick is held forward (and as long as there is fuel remaining). Acceleration is indicated by exhaust leaving the rear of the ship.

The ship will rotate clockwise while the joystick is held to the right of center, and counter-clockwise while held to

the left of center. Ships can be rotated as much as desired without using up any resources.

The actions may be combined. For example, holding the stick forward and to the right will cause the ship to accelerate while rotating clockwise.

Note that it only takes a small motion forward or to the side to control the ship. Pushing the stick all the way forward or to the side produces no additional effect.

Pulling the stick to the rear will cause the ship to enter HYPERSPACE (see next page). It is necessary to pull the stick at least 3/4 of the way back in order to accomplish this (unlike the comparatively subtle motions required for thruster and rotator control).

Pushing switch 1 on the console causes a torpedo to be fired from the torpedo tube located in the nose of the ship. The torpedo leaves the ship with a fixed forward velocity relative to the ship's velocity. To aim the torpedo you must aim the entire ship. A torpedo will destroy any ship or other torpedo which it may come very close to. Each ship has a limited number of torpedoes.

Torpedoes self-destruct after a short period. Their range is thus limited by their speed. Torpedoes are not affected by gravity so if they are fired in a forward direction by a ship near the sun (and thus going fast) they will fly away at great speed. If switch 1 is held down, torpedoes will be fired in a machine-gun-like fashion at the rate of about 2 per second at 2MHz CPU speed (or 4 per second at 4MHz).

When a player's ship is about to be blown up by a torpedo which can't be shot down, it is wise to enter HYPERSPACE as a last resort. This is done by pulling the joystick sharply to the rear. The ship will disappear, to reappear shortly thereafter in some random location disguised as a star. While in this state, it is vulnerable to torpedoes but cannot be controlled. Another second or two and it reappears as a spaceship, with a random velocity and attitude imparted to it by hyperspace. There is a small (1/8) chance that it will explode upon emergence from hyperspace - so hyperspace is indeed a last resort.

Special Environmental Details:

1. First one should note that space curves back upon itself in such a manner that the upper and lower boundaries of space coincide. Consequently, if a ship or a torpedo drifts off the top of the screen, it reappers on the bottom, and vice-versa. The same is true of the left and right boundaries. Experts will use this fact to "shoot around the screen" and a novice will find a torpedo attacking him from out of nowhere.
2. Since each opposite edge is identical in the simulated environment, all four corners are in reality one single spot in space (in fact, the spot furthest from the sun). If the sun attracts a ship too closely, rather than swallow it up, the ship is dumped "in the four corners". This spatial singularity adds interest to the game but a physics purist may suppress it (see OPERATING INSTRUCTIONS).

3. The stars in the background are part of a large star field which circulates about once per hour. These stars have no effect on the game, except for aesthetics and helping the players see the edges of the screen.

SCORING:

1. If both players run out of torpedoes, the game is counted as a tie.

2. When either ship explodes, the simulation continues for a few seconds (to make sure the survivor evades any remaining torpedoes) and then the survivor (if any) is credited with a win.

3. If your microprocessor has an IMSAI or CROMEMCO front panel with 8 programmed output lights, the score is kept there. The rightmost 4 bits for the player on the right and the leftmost 4 bits for the player on the left, naturally.

4. It is customary to play until one player achieves a certain score (usually 16- overflowing his 4 bit counter) and then he plays the next opponent. Shorter series, such as best 5 out of 9, are quite rewarding. To reset the score, restart the program (see below).

OPERATING INSTRUCTIONS

The starting address of the program is Ø. The game may be restarted by simultaneously depressing switches 2 and 3 on either console. (However, if either ship has exploded, the program will not respond to a restart request for several seconds)

OPTIONS

Several options may be selected when the game is restarted. Hold down the switches corresponding to the desired options on one console and depress and release switches 2 and 3 on the other console.

Switch	Option
2	Eliminate the sun (and its gravity).
3	Cause the sun to be lethal.
4	Eliminate the starfield.

(Combinations of options which do not involve both switches 2 and 3 are allowed).

TANK WAR

Tank War is a two-player computer game using two Cromemco JS-1 joystick consoles and the Cromemco Dazzler TV interface. The Tank War program itself requires 3K bytes of memory (beginning at location zero in memory space). An additional 3K bytes of RAM memory (from 3K to 6K in memory space) are required for picture storage and stack area.

The game begins with the words "TANK WAR" boldly displayed in color on the TV screen. To start playing, depress button 4 on both joystick consoles. Each player can then control his tank using his joystick. Missiles can be fired from the tank by depressing button 1 on the joystick console. Two points are scored when the opponent's tank is successfully hit by a missile. The opponent gains a point if a mine is contacted in the mine field. Score is kept automatically for each player in the upper corners of the playing screen.

The game continues until one of the players wins by reaching the score of 90. To start the game again depress buttons 2 and 3 on both joystick consoles.

TRACK

TRACK is a full-color TV game designed to be used with the Cromemco TV DAZZLER interface. Track is a game of skill and coordination. The object is to manipulate a cursor, under joystick control, through a spiral path toward the center goal. If, however, the player contacts the sides of the spiral in the process, the game is over and must start again.

TRACK begins with a white spiral track displayed on a bright green background. A joystick (Cromemco model JS-1) is used to control the yellow cursor on this track. Towards the center of the spiral the track narrows, requiring increasingly precise control of the cursor to avoid contacting the sides of the spiral. If the side of the spiral is hit, an alarm (in the JS-1 console) sounds, and the point of contact is turned bright red.

1. NOTATION

DAZZLECHESS uses a special octal notation to identify the squares of the chess board. Each square is represented by a two digit number. The first digit specifies the rank (0 to 7) from the computer's end of the board. The second digit specifies the file (0 to 7) from the computer's right (your left). A completely numbered board is shown below:

D A Z Z L E C H E S S

00	01	02	03	04	05	06	07
10	11	12	13	14	15	16	17
20	21	22	23	24	25	26	27
30	31	32	33	34	35	36	37
40	41	42	43	44	45	46	47
50	51	52	53	54	55	56	57
60	61	62	63	64	65	66	67
70	71	72	73	74	75	76	77

C H A L L E N G E R

This table is provided at the front of the manual for easy reference during the play of a game.

2. PROGRAM EXECUTION

DAZZLECHESS was originally conceived as a program which would play chess using a minimum microcomputer system. The program is given here on the DAZZLER games disk under the name DAZCHESS.COM and will run on all CROMEMCO Z80 based computers configured with 16K of contiguous RAM at location 0 and an ASCII I/O device (teletype or CRT).

The DAZZLECHESS program resides on disk and is executed by typing "DAZCHESS" in response to the CDOS prompt. It occupies approximately 4K of memory. After printing the initial sign-on message, DAZZLECHESS will ask: "DO YOU WANT WHITE? (Y,N)". If you wish to play white, respond with 'Y'. If you wish to play black, respond with 'N'. If you wish DAZZLECHESS to decide which color to play, respond with any other character. DAZZLECHESS will then display the board and prompt with a colon, indicating that the program is ready to receive any operating command.

Although DAZZLECHESS does not always play chess at the expert level, it will make a reasonable move under most circumstances. In addition to being great fun to play, it can provide a useful and tireless opponent for practicing checkmates, learning openings, and sharpening general playing skills.

The DAZZLECHESS program is supplied on the CROMEMCO Dazzler Games Disk (FDG-S or FDG-L). The documentation provided includes complete player's instructions, a description of the program operation, and a listing of a sample game of DAZZLECHESS.

3. DAZZLECHESS COMMANDS

DAZZLECHESS has seven special commands to which it will respond. Commands may be abbreviated to the first letter of the command word. All commands must be terminated with a carriage return. Typing errors may be corrected at any time by typing a control-X. This will clear the input buffer and allow you to retype the entire line.

COMMAND SUMMARY

COMMAND	FUNCTION
DISPLAY	Display the board at the console terminal (and on the TV screen if using a DAZZLER).
EXCHANGE	Exchange sides and display the board.
GO	Make a move from the current position.
SPEED	Change the mode of the computer's play.
RESIGN	End the game.
AUTO DISPLAY	Display the board on the CRT after each move.
NO DISPLAY	Do not display the board on the CRT automatically.

THE DISPLAY COMMAND

The DISPLAY command instructs the computer to display the current position of the internal chess board at the terminal and on the TV screen if you are using a Dazzler in your system. DAZZLECHESS is always illustrated at the top of the display, and you are always at the bottom. Each piece on the CRT is indicated by a two character mnemonic. The first character shows the color of the piece. The second character shows the type of piece occupying that square. Black squares which are unoccupied are illustrated by :: . The sample display below shows the board set up to begin a game with DAZZLECHESS playing black.

```
+---------- DAZZLECHESS ----------+
! BR BN BB BQ BK BB BN BR !
!                          !
! BP BP BP BP BP BP BP BP !
!                          !
!    ::    ::    ::    ::  !
!                          !
!  ::    ::    ::    ::    !
!                          !
!    ::    ::    ::    ::  !
!                          !
!  ::    ::    ::    ::    !
!                          !
! WP WP WP WP WP WP WP WP !
!                          !
! WR WN WB WQ WK WB WN WR !
+---------- CHALLENGER ----------+
```

The Dazzler display of DAZZLECHESS shows the board in yellow and red and the pieces in black and white. DAZZLECHESS is always located at the top of the screen and the CHALLENGER is located at the bottom.

THE GO COMMAND

The GO command instructs DAZZLECHESS to examine the current position of the board, choose the best move available, make that move, and then print out the move that it has made. This command may be entered at any time. The computer will not check to see if you have made any moves since the last computer move, or if it is making the first move with the black men. DAZZLECHESS trusts you. You must referee the game.

THE SPEED COMMAND

DAZZLECHESS can play chess at three different levels. The best level is called the NORMAL speed, and requires from 15 to 150 seconds per move for analysis (with ZPU running at 4MHz). By eliminating some time consuming portions of the strategic analysis, the speed can be increased. BLITZ mode requires only 10 seconds per move on the average, and SUPERBLITZ will make a move in about 5 seconds. In response to the SPEED command, DAZZLECHESS will ask: "WHICH MODE? (S,B,N)". Type one of the characters: S,B, or N to choose the desired speed. This command may be entered at any time during the game.

SPEED SUMMARY

ENTER	SPEED	TIME PER MOVE (4MHz)
S	SUPERBLITZ	3 to 5 seconds
B	BLITZ	5 to 15 seconds
N	NORMAL	15 to 150 seconds

THE RESIGN COMMAND

The RESIGN command may be entered at any time to end the game. DAZZLECHESS will display the final position of the board, and then ask if you wish to play again. If you type "N", control will be returned to CDOS.

THE EXCHANGE COMMAND

The EXCHANGE command enables you to turn the board around at any point during the game. This forces DAZZLECHESS to play with your pieces in the position that you have left them. You must play with the computer's pieces. The relative positions of the pieces remain the same, but the numbering of the squares changes because the notation always has its origin at the computer's lower right.

It is possible to have DAZZLECHESS play a game against itself by entering the EXCHANGE command, then the GO command, then the EXCHANGE command, and so on. Remember that each move printed is being described from opposite ends of the board because of the intervening exchanges. The EXCHANGE command automatically displays the board in its new configuration. If you are using a teletype and wish to override this feature, simply issue the N (NO DISPLAY) command.

DISPLAY OPTIONS

Two display option commands are available at the DAZZLECHESS command prompt. These are AUTO DISPLAY and NO DISPLAY. Entering the AUTO DISPLAY command causes the program to display the board on the CRT immediately after each move made by either side. Entering the NO DISPLAY command will turn off the automatic console display feature. This is demonstrated in the sample game in Section 8. The default option in the copy of DAZZLECHESS you have received is AUTO DISPLAY. The Dazzler display is always updated after every move.

4. ENTERING YOUR MOVE

Your move is described to DAZZLECHESS by specifying the square the piece was moved from, and the square the piece was moved to, using the octal notation described above. For example, with the computer playing white, a KP to KP4 response would be entered at the colon prompt as:

```
: 63-43
```

DAZZLECHESS will immediately move the appropriate piece internally and begin to consider its response. The GO command is assumed as soon as the move is entered. Note that DAZZLECHESS carries out no legal validity check on your move. The program will accept a move of any piece on the board to any square on the board. If the square you move the piece to is occupied, the occupying piece will be captured and removed from the board. Therefore, it is very important when entering your move to take great care not to enter an incorrect square number. As with the commands, typing errors may be corrected by typing a control-X and retyping the entire line. If a piece has been captured accidentally by the move of another piece (ie, if the capturing piece was moved incorrectly), there is no way to restore the captured piece to the board other than to note down the locations of all pieces, type "R", and then start a new game, setting up the pieces in the original configuration by typing a series of "M" commands (see Section 5).

5. SPECIAL MOVES

There are several unique moves allowed in chess which have also been implemented in DAZZLECHESS. These are described in the following sections.

SETTING UP A SPECIAL POSITION

Normally, DAZZLECHESS begins to consider its response as soon as you have entered your move in the format shown above. If you wish to inhibit this action, in order to make two consecutive moves to set up a test position, or to make an en passant capture as described below, enter an M after the move. For example:

```
: 63-43M
```

DAZZLECHESS will move the appropriate piece on its internal chess board, and then return to the command mode for further commands or moves. Note once again that you may move any piece on the board in this manner. This includes the computer's pieces, which you may wish to move in order to set up a special position.

CASTLING

Castling is accomplished by entering O-O to castle on the King's side (short), and O-O-O to castle on the queen's side (long). The letter O is used, not the numeral Ø.

```
: O-O
```

PAWN PROMOTION

If you move a pawn to the eighth rank (rank 0 in the octal notation of DAZZLECHESS), you may promote it to a piece. This may be done by following the move entry by an equal sign and the mnemonic of the piece you wish the pawn promoted to. For example, if you wish to promote the King pawn to a Queen, the following move would be entered:

```
: 13-03=Q
```

Because of the internal board representation of DAZZLECHESS, only one queen is allowed per side at any given time. If you already have a queen, it will be necessary to choose another piece which has already been lost.

EN PASSANT

En passant pawn capture may be accomplished by making two moves with the capturing pawn. The first move is a lateral move to capture the computer's pawn. The second move is forwards to the final square that you are moving your pawn to. For example, a capture of the computer's queen pawn which has just moved from 14 to 34 with your king pawn, now located at 33, is accomplished by first moving 33 to 34 to capture the pawn (using the M suffix to prevent

EN PASSANT, con't

DAZZLECHESS from moving), and then moving form 34 to 24 to move your pawn to the appropriate final square.

: 33-34M
: 34-24

6. THE COMPUTER MOVE

DAZZLECHESS indicates its move using the same notation that you use to enter your moves. To distinguish your moves from those of the computer when going over an old listing, the computer's moves are preceded by the notation "DC : ", as shown in the example game illustrated in Section 8. En passant capture is not a part of the DAZZLECHESS move generation routines. Consequently, the computer will never capture en passant or recognize the danger of you capturing en passant when it formulates its optimum move.

Some players may find that their level of play exceeds that of DAZZLECHESS. In order to make the game more challenging, these players may make the same sacrifice they might make to a weak human player. They can spot the computer a piece by removing it at the beginning of the game, or shortly after the opening play is concluded. This can easily be done by capturing it with one of your own pieces, then returning the piece to its own square. For example:

```
: 74-73M
: 73-74M
```

DAZZLECHESS has been designed for your enjoyment. Have fun!

7. THE PROGRAM

The program is divided into three functionally distinct sections: the control and I/O routines, the move generation and data collection routines, and the strategic analysis routines.

CONTROL AND INPUT/OUTPUT

This section of the program is responsible for all communications between the computer and the human player. The primary functions carried out are the board set up, and data table initialization sections. In addition to this, the various input commands are interpreted and subroutines are called which execute them. The most important subroutine called by the control section is the chess program itself. This is a complex set of routines which examine the current state of the chess board and return a move which has been evaluated as the best available.

MOVE GENERATION

The second major subsection of the program consists of a set of subroutines which generate legal moves from a given position. DAZZLECHESS, unlike most larger chess playing programs, evaluates its opportunities in a serial manner. That is, it generates an available move, and evaluates it completely before generating the next available move. The evaluation routines calculate a value for each move which is compared with the value of the best move found so far. If it is better, it becomes the best move for comparison with future moves generated. The move with the highest value will be selected by DAZZLECHESS.

To generate all the moves for a side DAZZLECHESS works through a table which contains the board position of each piece. First, a king pawn move is generated and evaluated. The evaluation includes the actual moving of the piece, and the generation of potential reply moves by the challenger. The sequence of trial moves of the computer's pieces and the challenger's pieces may extend as far as three moves for each side beyond the current position. At the end of this time, each move made will be taken back, until the board is returned to its original state. Then, the next available move will be made, and the replies tested. this continues until all the moves for each piece have been tested. DAZZLECHESS is capable of generating and evaluating about 20,000 moves per second. Thus, in a 150 second analysis 3,000,000 moves will be made and taken back in an attempt to evaluate the available moves.

DATA COLLECTION

For each test move available to the computer data are collected which will allow it to evaluate the resulting position. In the normal mode of operation DAZZLECHESS collects the following information for use by the strategy algorithms.

DATA COLLECTION, con't

MOBILITY (μ) This represents the number of legal moves that a side has available to it from a given position.

MAXIMUM CAPTURABLE PIECE (ρ). The value of the most valuable piece presently being attacked by a side.

TOTAL ATTACK (α). The sum of the values of all the pieces under attack by a side.

CAPTURE (ψ). The value of any piece captured by the current move, or the maximum available capute in a future move which can be achieved by a series of captures (an exchange).

The mobility, maximum capturable piece, and the total attack are obtained for the current position and the position after the test move has been made for both the computer and its opponent. Capture values are calculated to a depth of three moves per side beyond the current position provided the position examined can be achieved by a continuous sequence of piece captures. In addition the value of the moving piece and the squares it occupies before and after the move are used in the evaluation.

STRATEGY

After a test move has been generated and the parameters above have been collected by the data collection routines, the strategic analysis algorithm assigns a value to the move. The basic algorithm is a linear combination of the various parameters. The basic value is then modified by factors such as the availability of a checkmate, or a positional bonus for motion to the center or out of the back rank.

$$\begin{aligned} \text{VALUE} = {} & 4.00\psi_1 + 1.25\psi_2 + 0.75\rho_1 + 0.75\alpha_1 + 0.25\mu_1 \\ & + 0.25\psi_3 - 3.00\rho_1' - 2.00\alpha_1' - 1.25\psi_1' - 0.25\rho_0 \\ & - 0.25\alpha_0 - 0.25\psi_2' - 0.25\psi_3' - 0.25\mu_0 \end{aligned}$$

($'$) signifies the challenger's value

(n) subscript signifies the position at time n.
(time 0 is the current board position)

VALUE = VALUE + 2 if a piece is moved from the back rank.

VALUE = VALUE + 2 if a piece is moved to the center.

VALUE = -1 if the challenger is checkmated.

STRATEGY, con't

The algorithm used by DAZZLECHESS is a relatively simple one compared to major chess programs which can compete at an expert level of play. As a result, the computer must make the decision between positional development or material advantage based upon the few factors outlined above. Good chess is considerably more complex and requires that the player use algorithms which vary from time to time during the game. DAZZLECHESS has only a single algorithm which must be used at all stages during the game (except for a few opening moves which can be played from a limited book). This single algorithm is a compromise of the possible opening, middle game, end game, and special situation algorithms.

8. TYPICAL DAZZLECHESS GAME

```
  CROMEMCO DAZZLECHESS
(C) 1977 - MICROWARE LTD.
```

```
DO YOU WANT WHITE ? (Y,N) N
+---------- DAZZLECHESS ----------+
! WR WN WB WK WQ WB WN WR !
!                          !
! WP WP WP WP WP WP WP WP !
!                          !
!    ::    ::    ::    ::  !
!                          !
! ::    ::    ::    ::     !
!                          !
!    ::    ::    ::    ::  !
!                          !
! ::    ::    ::    ::     !
!                          !
! BP BP BP BP BP BP BP BP !
!                          !
! BR BN BB BK BQ BB BN BR !
+---------- CHALLENGER ----------+
```

USER DECIDES TO PLAY BLACK.

THE BOARD IS AUTOMATICALLY DISPLAYED AT THE BEGINNING OF THE GAME SINCE AUTO DISPLAY IS THE DEFAULT MODE.

```
:    NO DISPLAY

:    SPEED

WHICH MODE ? (S,B,N) S
:    GO
DC : 13-33
:    63-43
DC : 01-22
:    76-55
DC : 02-46
:    71-52
DC :  0-0
:    AUTO
+---------- DAZZLECHESS ----------+
!    WK WR :: WQ WB WN WR !
!                          !
! WP WP WP    WP WP WP WP !
!                          !
!    :: WN ::    ::    ::  !
!                          !
! ::    :: WP ::    ::     !
!                          !
!    ::    BP    :: WB ::  !
!                          !
! ::    BN    :: BN ::     !
!                          !
! BP BP BP :: BP BP BP BP !
!                          !
! BR    BB BK-BQ-BB :: BR !
+---------- CHALLENGER ----------+
```

SUPPRESS DISPLAY TEMPORARILY.

USER WISHES TO SELECT THE SPEED OF PLAY.
USER SELECTS SUPERBLITZ MODE.
GO COMMAND CAUSES DAZZLECHESS TO MOVE FIRST.
THESE MOVES ARE PLAYED:

```
DC:1   P-K4      P-K4  :USER
   2   N-KB3     N-QB3
   3   B-N5      N-B3
   4   0-0       ...
```

DC CASTLES KING-SIDE.
USER TURNS ON THE AUTOMATIC DISPLAY FEATURE.

THE BOARD IS NOW DISPLAYED AFTER EVERY MOVE.

AUTO DISPLAY BOTH SETS DC FOR AUTOMATIC DISPLAY AND ALSO DISPLAYS THE CURRENT BOARD POSITION.

```
:     52-33
+---------- DAZZLECHESS ----------+
!     WK WR :: WQ WB WN WR !
!                                !
! WP WP WP     WP WP WP WP !
!                                !
!     :: WN ::     ::     :: !
!                                !
! ::     :: BN ::     ::     !
!                                !
!     ::     BP     :: WB :: !
!                                !
! ::     ::     :: BN ::     !
!                                !
! BP BP BP :: BP BP BP BP !
!                                !
! BR     BB BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

```
DC :  14-34
+---------- DAZZLECHESS ----------+
!     WK WR :: WQ WB WN WR !
!                                !
! WP WP WP     :: WP WP WP !
!                                !
!     :: WN ::     ::     :: !
!                                !
! ::     :: BN WP     ::     !
!                                !
!     ::     BP     :: WB :: !
!                                !
! ::     ::     :: BN ::     !
!                                !
! BP BP BP :: BP BP BP BP !
!                                !
! BR     BB BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

```
:     NO DISPLAY

:     72-63
DC :  04-13
:     33-54
DC :  46-55
```

```
   4    ...       NXP
```

```
   5    P-Q4      ...
```

USER TURNS OFF THE AUTOMATIC DISPLAY.

```
   5    ...       B-K2
   6    Q-K2      N-Q3
   7    BXN       ...
```

```
:     DISPLAY
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB WN WR !
!                             !
! WP WP WP WQ :: WP WP WP !
!                             !
!     :: WN ::     ::     :: !
!                             !
! ::     ::     WP     ::     !
!                             !
!     ::     BP     ::     :: !
!                             !
! ::     ::     BN WB ::     !
!                             !
! BP BP BP BB BP BP BP BP !
!                             !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

USER REQUESTS A BOARD DISPLAY.

DISPLAY SHOWS THE BOARD WITHOUT PUTTING DC BACK INTO AUTO MODE.

```
:     EXCHANGE
:     DISPLAY
+---------- DAZZLECHESS ----------+
! BR :: BB BQ BK ::     BR !
!                             !
! BP BP BP BP BB BP BP BP !
!                             !
!     :: WB BN     ::     :: !
!                             !
! ::     ::     BP     ::     !
!                             !
!     ::     WP     ::     :: !
!                             !
! ::     ::     :: WN ::     !
!                             !
! WP WP WP :: WQ WP WP WP !
!                             !
! WR WN WB     :: WR WK     !
+---------- CHALLENGER ----------+
```

USER EXCHANGES PIECES WITH DAZZLECHESS.

THE BOARD IS DISPLAYED WITH THE PIECES EXCHANGED. DAZZLECHESS IS NOW BLACK AND THE CHALLENGER IS WHITE.

```
:     EXCHANGE
:     AUTO
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB WN WR !
!                             !
! WP WP WP WQ :: WP WP WP !
!                             !
!     :: WN ::     ::     :: !
!                             !
! ::     ::     WP     ::     !
!                             !
!     ::     BP     ::     :: !
!                             !
! ::     ::     BN WB ::     !
!                             !
! BP BP BP BB BP BP BP BP !
!                             !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

EXCHANGE PIECES BACK TO THE ORIGINAL POSITION. TURN ON AUTO DISPLAY.

```
:     66-55
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB WN WR !
!                             !
! WP WP WP WQ :: WP WP WP !
!                             !
!     :: WN ::     ::     :: !
!                             !
! ::     ::     WP     ::     !
!                             !
!     ::     BP     ::     :: !
!                             !
! ::     ::     BN BP ::     !
!                             !
! BP BP BP BB BP BP     BP !
!                             !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

```
DC : 34-43
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB WN WR !
!                             !
! WP WP WP WQ :: WP WP WP !
!                             !
!     :: WN ::     ::     :: !
!                             !
! ::     ::     ::     ::     !
!                             !
!     ::     WP     ::     :: !
!                             !
! ::     ::     BN BP ::     !
!                             !
! BP BP BP BB BP BP     BP !
!                             !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

```
:     54-66
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB WN WR !
!                             !
! WP WP WP WQ :: WP WP WP !
!                             !
!     :: WN ::     ::     :: !
!                             !
! ::     ::     ::     ::     !
!                             !
!     ::     WP     ::     :: !
!                             !
! ::     ::     :: BP ::     !
!                             !
! BP BP BP BB BP BP BN BP !
!                             !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+
```

7	...	PXB
8	PXP	...
8	...	N-N2

```
DC : 06-25
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB     WR !
!                                !
! WP WP WP WQ :: WP WP WP !
!                                !
!     :: WN ::     WN     :: !
!                                !
! ::     ::     ::     ::     !
!                                !
!     ::     WP     ::     :: !
!                                !
! ::     ::     :: BP ::     !
!                                !
! BP BP BP BB BP BP BN BP !
!                                !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+

:     RESIGN

YOU RESIGNED - I WIN!
+---------- DAZZLECHESS ----------+
!     WK WR ::     WB     WR !
!                                !
! WP WP WP WQ :: WP WP WP !
!                                !
!     :: WN ::     WN     :: !
!                                !
! ::     ::     ::     ::     !
!                                !
!     ::     WP     ::     :: !
!                                !
! ::     ::     :: BP ::     !
!                                !
! BP BP BP BB BP BP BN BP !
!                                !
! BR     :: BK BQ BB :: BR !
+---------- CHALLENGER ----------+

PLAY AGAIN ? (Y,N) N

THANKS FOR THE GAME... DAZZLECHESS
```

```
9    N-QB3     ...

9    ...       RESIGN

USER RESIGNS; END OF GAME.

THE FINAL BOARD POSITION
IS PRINTED AUTOMATICALLY.
```

APPENDIX A

DAZZLER ENGINEERING CHANGES

In order for your REV B or REV C series Dazzler to operate properly with the Cromemco games diskette, the following engineering changes must be made:

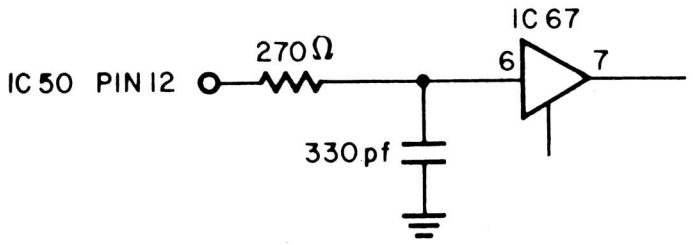
REV B DAZZLER ONLY

1) Remove (or bend out) pin 10 of Dazzler IC 29 (A 7400 IC).

2) Remove (or bend out) pin 12 of Dazzler IC 66 (A 7405 IC).

REV B AND REV C DAZZLERS

1) Add a 270 ohm resistor and 330 picofarad capacitor to the Dazzler as shown below:



2) On Dazzler board 2 connect a jumper wire from finger 54 of the S-100 bus connection (EXT. CLEAR) to finger 75 of the S-100 bus (RESET).

3) There are 4 pads on board 2 just above IC57 in a triangle. Cut the trace on the component side which runs between the two leftmost pads. This trace connects IC57P12 to IC49P1. Put a wire jumper so that IC49P1 connects to IC57P11 instead. This eliminates the bus float state at DMA transfer.