S. D. SYSTEMS

USER'S MANUAL

FOR

VDB-8024

INDEX

APPENDICES

SECTION I

GENERAL INFORMATION

1-1 INTRODUCTION

VDB-8024 is a video display board which provides a high quality means for interfacing a monitor and keyboard to the S-100 bus. The display is interfaced through the S-100 bus using a single output port and provides an input port through which a keyboard can be interfaced to the S-100 bus. The output generated by the board is both composite video and separate TTL levels for horizontal sync, vertical sync and video input. This provides an easy interface to most standard monitors. The video display board, with the addition of a keyboard and a monitor, functions as a complete terminal.

1-2 GENERAL DESCRIPTION

The VDB utilizes a Z80 microprocessor to perform the control functions of a video terminal. These functions inlcude LF, CR, full cursor control, home, clear, scroll and back space. In addition to the basic function several special additional features are provided. One of these features provides for specified fields of characters to be enhanced. This field can be enhanced in any of the following ways: Underline, Reverse, Blink, Protect or combinations. Another feature

of this board is the programmable character generator. This is a 7 x 8 dot character matrix with 2 bits of descenders to provide upper and lower case characters in a 7 x 10 dot field. 128 characters are typically available while 256 characters can be made available using a 2K x 8 PROM. These characters are displayed in a field of 80 characters in length and 24 lines per page. The VDB processor runs only during H & V sync to eliminate any disturbance of the display due to the processor running during the raster scan. There are several software controllable functions. These include a speed control similar to a baud rate control and also a scroll up or scroll down. In addition, a set of 32 special characters are available.

SECTION II

FUNCTIONAL DESCRIPTION

2-1 INTRODUCTION

The VDB hardware performs all control and timing functions as well as the special enhancement functions. This section will describe that hardware. Section III will describe the software control characters which must be output to the VDB to accomplish the special functions.

2-2 CRT 5027

The CRT 5027 video timer and controller is used to perform character count, character line count and row count. The outputs of these counters are then fed into the RAM or Character Generator (CGEN) to provide the proper scanning and display of each character in its proper place. This chip also provides for proper cursor control, horizontal sync, vertical sync and blinking signals.

2-3 Z80 MICROPROCESSOR

The Z80 executes the software which controls all functions of the system. This includes inputting data, storing data in memory, initializing the CRT 5027, controlling the special functions, cursor control and scrolling. These functions will be discussed in detail in the software section.

2-4 DATA OUT BUS

The 8 bit Data Out is the S-100 path for transferring data from the computer to the output port on the VDB board. This is the port through which all characters and control words are transferred to the display.

2-5 DATA IN BUS

The 8 bit Data In Bus is the S-100 path for transferring data from the input ports (keyboard data) to the computer (CPU).

2-6 A0-A7

The A0-A7 low order eight address lines are used by the computer (CPU) to address the input/output ports on the board.

2-7 I/O CONTROL LINES AND READ/WRITE CONTROL

The I/O Control lines consist of PWR, PDBIN, SOUT, SINP. These lines are used to control the input and output operations from/to the I/O ports on the board.

2-8 ADDRESS DECODER

The Address Decoder is used to address the ports on the VDB. These ports are initially addressed with port 0 for status and port 1 for data.

2-9 DATA IN LATCH

The Data In Latch isolates the keyboard from the S-100 Data In Bus. When data is ready, the keyboard strobe sets a latch and bit 1 of status port 0 goes high to indicate the input is valid. The input data is then read from port 1.

2-10 DATA OUT LATCH

The Data Out Latch isolates the Bi-Directional Data Bus used on the VDB from the S-100 Data Out Bus. When a word is written into output port 1, bit 2 of status port 0 goes low to indicate that the output port is busy. This also interrupts the VDB processor which will then read the latch and set the status bit to indicate the port is ready.

2-11 BI-DIRECTIONAL DATA BUS

The Bi-Directional Data Bus is the main path for communication between components on the VDB. This includes the Z80, input ports, output port, PROM, RAM, CRT 5027, special function latch and character generator latch.

2-12 KEYBOARD

Any ASCII encoded keyboard which has 7 data bits and a strobe line can be used. The 7 bits of data are stored in the Input Data Latch by the strobe line.

2-13 PROM

The PROM memory stores the program to be executed by the Z80.

2-14 RAM

The RAM stores the data which is scanned by the CRT 5027 and display upon the screen. The highest portion of the RAM which is not displayable is used as a stack by the Z80 during subroutine calls.

2-15 MUX

This determines whether the Z80 or the CRT 5027 will address the RAM. During the active scans the CRT 5027 will address the RAM and during V & H sync the Z80 will address the RAM. This will result in a clean display with no interference to the screen when characters are output to the VDB.

2-16 OSCILLATOR & DOT COUNTER

This is used to generate the dot shift rate and the dot counter carry. The dot counter carry is used by the CRT 5027 to increment the character counter and is used to load the data into the shift register.

2-17 CGEN

The Character Generator (CGEN) is a 1K PROM which is organized in a 7 x 8 dot matrix. The character generator is addressed by the CRT 5027 and the output of the RAM. The RAM points to the proper character within the PROM and the CRT 5027 points to the correct row of that character. A 2K PROM can be used for the CGEN to provide an extended set of characters.

2-18 SPECIAL FUNCTION LATCH

This 8 bit latch provides a means for software control of the special function. These functions include underline field, block field, reserve field as well as several others.

2-19 COMBINATIONAL LOGIC

The combinational logic is the hardware which performs the special functions. This generates the inverse, blanking, and blinking signals needed to control the output.

2-20 CHARACTER ROW COUNTER

This counter determines which row of a character will be addressed by the CGEN and latched into the shift register. It is also used to determine the proper blanking for lower case letters and for underline.

2-21 SHIFT REGISTER

The output of the CGEN is latched into this shift register and shifted out to produce the proper dot sequence. This is the feed to the combinational logic which will could either blank or invert the signal.

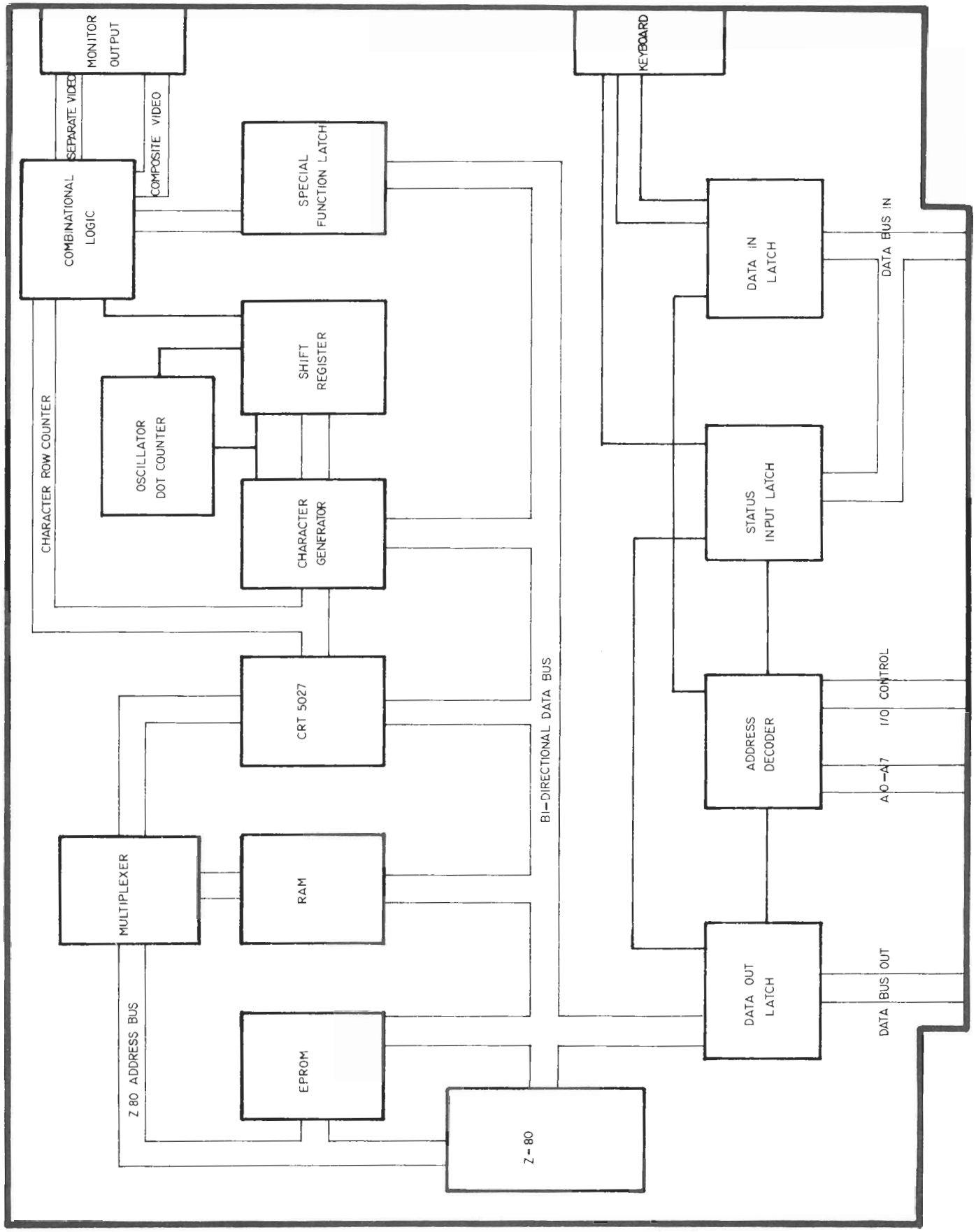
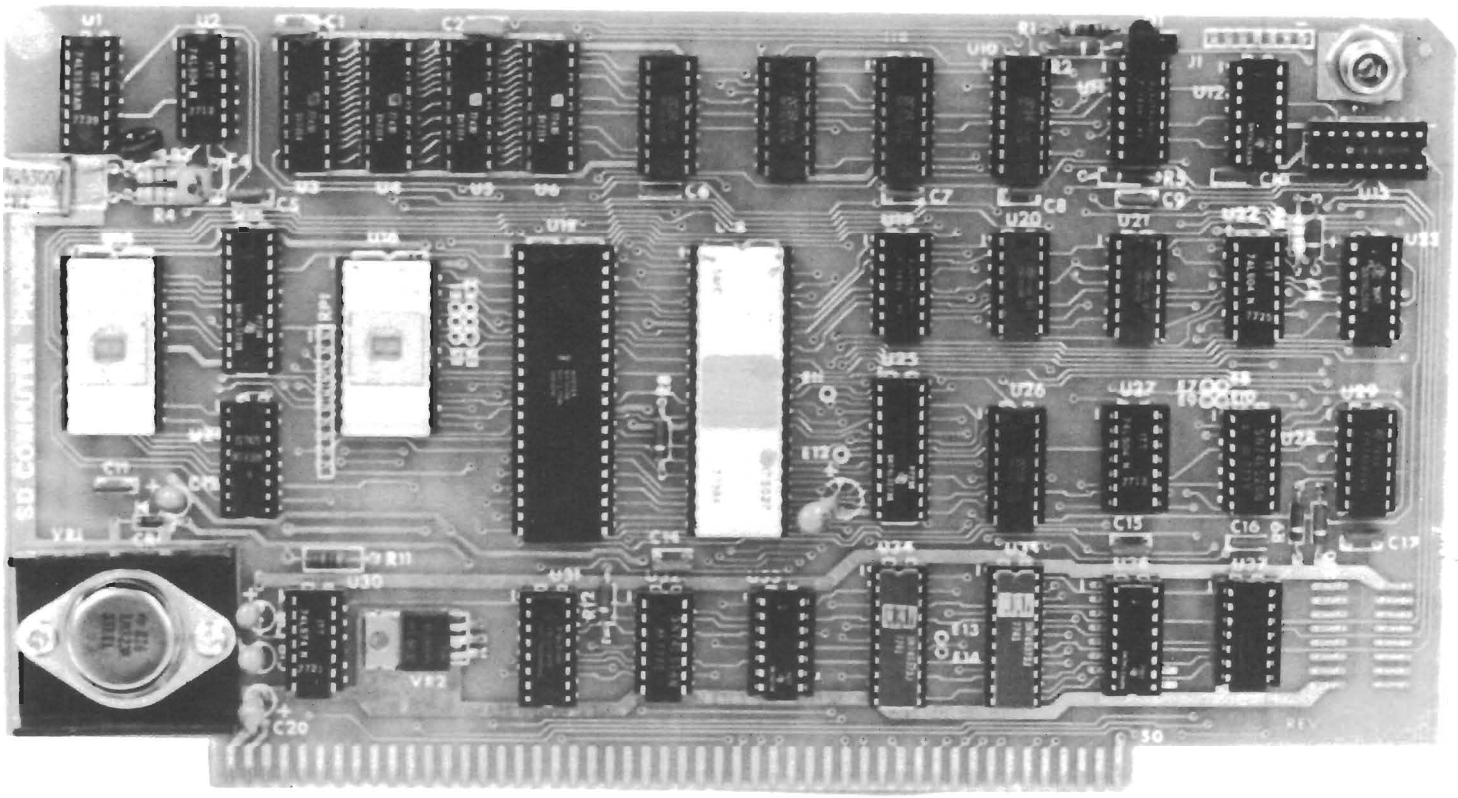

MONITOR OUTPUT
SEPARATE VIDEO
COMPOSITE VIDEO
KEYBOARD
COMBINATIONAL LOGIC
SPECIAL FUNCTION LATCH
DATA IN LATCH
DATA BUS IN
SHIFT REGISTER
OSCILLATOR DOT COUNTER
CHARACTER ROW COUNTER
CHARACTER GENERATOR
STATUS INPUT LATCH
CRT 5027
BI-DIRECTIONAL DATA BUS
ADDRESS DECODER
I/O CONTROL
A0-A7
MULTIPLEXER
RAM
DATA OUT LATCH
DATA BUS OUT
Z 80 ADDRESS BUS
EPROM
Z-80
S-100 BUS

FIGURE 2-1

VDB - 8024 Video Display Board



SD Systems

SECTION III

CONTROL CHARACTERS

3-1 INTRODUCTION

The Z80 is used to perform two main functions: keep track of data or cursor position and to perform some control function as a result of a control character. From a user's viewpoint, the control characters are very important to understand to be able to fully utilize the power of the VDB. This section will describe the function of the control words used by the VDB.

3-2 SCROLLING

Scrolling is a method of displaying data which allows the most recently entered data to remain upon the screen while the old data is removed. This is accomplished by moving every line up one line and entering the next line at the bottom of the page. The top line on the page is then eliminated from the display. This method of scrolling in which every line is moved up is called Scrolling Up. There is another method of scrolling in which the data is moved down instead of up. This allows the last line to be entered on the top of the page instead of the bottom and the bottom line is eliminated. This method will be referred to as Scrolling Down or Reverse Scrolling.

In the VDB 8024, both methods of scrolling are available for usage. They are controlled by Control A and Control B for Scrolling Up and Scrolling Down. When a Control A is output to the display the VDB will enter a Scroll Up mode. It will remain in this mode until a Control B is output at which time it will enter a Scroll Down mode. The default mode is Scrolling Up.

3-3 EXTRA CHARACTER SET

The extra character set consists of 32 characters which provide the user with many special symbols such as greek letters, upper script and lower script.

In order to display these characters a Control C must be output to the device followed by a letter corresponding to the special letter needed. A summary of the special letters and their corresponding letters are shown in Table 3-1. The Control C must be entered before every special character needed because it only affects the character which is output immediately following the Control C.

3-4 CONTROL BITS

There are two control bits which are available on the VDB to be used for hardware control. These bits are controlled using four control characters. Bit #1 is turned on by outputting a Control D to the VDB and is turned off by outputting a Control E. Bit #2 is turned on or off by outputting a Control F or Control G. These are user defined hardware control functions.

SPECIAL CHARACTER	CHARACTER FOLLOWING CONTROL C
α	@, `
β	A, a
γ	B, b
δ	C, c
ϵ	D, d
θ	E, e
ι	F, f
λ	G, g
μ	H, h
ν	I, i
π	J, j
Σ	K, k
Φ	L, l
Ψ	M, m
ω	N, n
Ω	O, o
$\circ$	P, p
$\frac{1}{4}$	Q, q
$\frac{1}{2}$	R, r
$\frac{3}{4}$	S, s
$\circ$	T, t
^{2}	U, u
$\pm$	V, v
$\div$	W, w
$\approx$	X, x
$\surd$	Y, y
$\int$	Z, z
$\vert$	[, {
$\leftarrow$	\, |
$\rightarrow$	], }
$\uparrow$	^, ~
$\downarrow$	_, ▒

TABLE 3-1

The VDB is set up such that a control bit can be used in conjunction with an expanded character set. In this case a character generator must be specially programmed with two sets of characters. (See Section on Programming Character Generator). Then the control bit is used to select one of the two character sets. If Bit #1 was used to control this option then a Control D would cause character Set 1 to be used and a Control E would then go to character Set 2.

3-5 CURSOR CONTROL

The cursor control characters provide the user with a means of moving the cursor in any of four directions. The back space or Control H character causes the cursor to go to the left one space until it gets to the left most margin. This is not a destructive backspace. The line feed command advances the cursor one line until it gets to the last line at which time it will initial a scroll function. The up line or Control K command is used to move the cursor up until it reaches the top of the page at which point it will stop. The forward space, unlike the space, is a nondestructive forward space and is not a displayable character. This allows the user to space over existing data without destructing it. The last cursor control is the tab command. This will move the cursor to the right until it gets to the next even multiple of eight character spaces. This is similar to tabs being set every eight spaces on a typewriter. The cursor may be moved to any row and column using the sequence ESC=YX, where ESC is $1B_H$, = is 3DH, Y is the row +20H and X is the column +20H.

3-6 SPEED CONTROL

The VDB has an asynchronous type of execution and the speed varies with the control words output to the VDB. This means there is no baud rate that can be associated with each speed. Therefore, the speeds are divided between fast, medium and slow. These speeds have been compared to a synchronous display and are in the range of 19200, 2400 and 300 baud. These are only approximate baud rates and are given only to relate the speed of the display to some standard.

These three speeds are programmable using three control words. The slow speed is set by a Control M, medium speed by a Control N and fast by a Control O.

3-7 ENHANCEMENT FIELD

The enhancement field involves a method of making a group of characters stand out and catch the attention of the user. The enhancement field initiated by outputting a control character to the VDB which tells the display that the following characters are to be enhanced. All characters following will be enhanced until a Quit command, Control Q, is output to the display. The Control Q will stop the enhancement field and characters entered after the Quit command will not be enhanced.

There are several types of enhancement fields that can be entered using control characters. The reverse field is started by outputting a Control R to the display. The reverse field causes the characters in the enhanced field to be inverted so that they are black letters on a white background. The blinking field is started by using a Control T character. The blinking field will cause the characters to blink on and off with a 75% duty rate. The underline will cause a character to be underlined. This is started by outputting a Control U character to the display. The no enhancement command, Control W, will cause no field to be entered. The use of this command is discussed later in conjunction with the Protect Field.

There are two other types of enhancement which are available to the user. These involve combination of other enhancements. The blinking underline and the blinking reverse are started using controls V and Control S. All of the enhancement fields are started by entering the appropriate control letter and they are ended by outputting a Control Q or Quit command. Only one enhancement mode is available per page. If a second type of enhancement mode is entered, then all enhancement fields will change to the mode most recently entered.

3-8 PROTECT FIELD

The protect mode command will cause any enhancement field entered to be protected. This results a field that cannot be overwritten by the user. The no enhancement field command (Control W) is available so that the user has the ability to protect unenhanced characters as well as enhanced characters. The unprotected field will unprotect the display and the display can then be overwritten. The protect mode is initiated using a Control X and is unprotected using a Control Y.

$X^c, R^c, \ldots, Q^c$

PROTECTED IN REVERSE

CONTROL CHARACTER	FUNCTION	ASCII CODE
CTR-A	Scroll	01
CTR-B	Reverse Scroll	02
CTR-C	Extra Character	03
CTR-D	Set Control Bit #1	04
CTR-E	Reset Control Bit #1	05
CTR-F	Set Control Bit #2	06
CTR-G	Reset Control Bit #2	07
CTR-H	Back Space	08
CTR-I	Tab	09
CTR-J	Line Feed	0A
CTR-K	Up Line	0B
CTR-L	Forward Space	0C
CTR-M	Carriage Return	0D
CTR-N	Slow	0E
CTR-O	Medium	0F
CTR-P	Fast	10
CTR-Q	Quit	11
CTR-R	Reverse	12
CTR-S	Blinking Reverse	13
CTR-T	Blinking	14
CTR-U	Underline	15
CTR-V	Blinking Underline	16
CTR-W	No Enhancement	17
CTR-X	Protect Mode	18
CTR-Y	Unprotected Mode	19
CTR-Z	Clear	1A
ESC=XY	Addressable Cursor	1B
CTR-	Home	1E

SUMMARY OF CONTROL CHARACTERS

TABLE 3-2

$b_3b_2b_1b_0$	b_6 0 b_5 0 b_4 0 (Ø$_H$)	0 0 1 (1$_H$)	0 1 0 (2$_H$)	0 1 1 (3$_H$)	1 0 0 (4$_H$)	1 0 1 (5$_H$)	1 1 0 (6$_H$)	1 1 1 (7$_H$)
0 0 0 0 (Ø$_H$)	NUL	FAST	SPACE	0	@	P	`	P
0 0 0 1 (1$_H$)	SCROLL	QUIT	!	1	A	Q	a	q
0 0 1 0 (2$_H$)	REVERSE	REVERSE	"	2	B	R	b	r
0 0 1 1 (3$_H$)	EXTRA CHARACTER	BLINK-ING RE-VERSE	#	3	C	S	c	s
0 1 0 0 (4$_H$)	SET CONTROL BIT #1	BLINK-ING	$	4	D	T	d	t
0 1 0 1 (5$_H$)	RESET CON-TROL BIT #1	UNDER-LINE	%	5	E	U	e	u
0 1 1 0 (6$_H$)	SET CONTROL BIT #2	BLINKING UNDER-LINE	$ &	6	F	V	f	v
0 1 1 1 (7$_H$)	RESET CON-TROL BIT #2	NO EN-HANCE-MENT	'	7	G	W	g	w
1 0 0 0 (8$_H$)	BACK SPACE	PROTECT MODE	(	8	H	X	h	x
1 0 0 1 (9$_H$)	TAB	UNPRO-TECTED MODE	)	9	I	Y	i	y
1 0 1 0 (A$_H$)	LINE FEED	CLEAR	*	:	J	Z	j	z
1 0 1 1 (B$_H$)	UP LINE	ESC= YX	+	;	K	[	k	{
1 1 0 0 (C$_H$)	FORWARD SPACE	∝	,	<	L	\	l	!
1 1 0 1 (D$_H$)	CARRIAGE RETURN	→	-	=	M	]	m	}
1 1 1 0 (E$_H$)	SLOW	HOME	.	>	N	^	n	~
1 1 1 1 (F$_H$)	MEDIUM	↓ (^–)	/	?	O	–	0	DEL

ASCII ENCODED CHARACTERS

TABLE 3-3

SECTION IV

PROGRAMMABLE CHARACTER GENERATOR

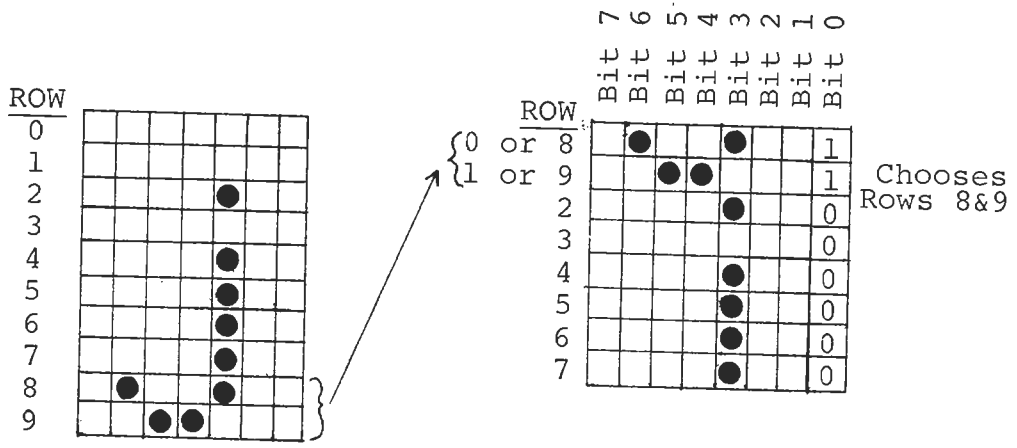
The character generator (CGEN) used in the VDB is programmable and the character fonts can be changed by replacing the CGEN. This section will discuss how to program a PROM to be used as a new CGEN. First the organization of the character within the PROM memory will be discussed.

Each character is made by a matrix of 7 dots by 8 dots. (Figure 4-1) Each row of the matrix is a single byte in memory with eight bytes forming a complete character. A 1K x 8 PROM is used and can hold up to 128 characters. A 2K x 8 can also be used to provide 256 characters.

The low order 3 address lines into the PROM are used to address a certain row of each character. The next 7 lines address the character. Each character is programmed on eight bit boundary starting with the top row of the character matrix. Care must be taken to insure that the PROM address bits 3 through 9 correspond to the ASCII code for the character to be displayed.

Lower case letters with descenders must be handled in a special way. A character is programmed within a 7 x 8 dot matrix with bit 0 of each byte not used. This bit is used to tell the hardware whether to display the first or second byte of the character on line 0 or 1 or on line 8 or 9. This will result in a 8 x 8 matrix in memory with bit 0 indicating when descenders should be displayed.

The letter j will be used as an example to illustrate how the CGEN is programmed. Figure 4-1 A shows the letter j in a 7 x 10 dot matrix as it will be displayed. In order to program the CGEN properly lines 8 and 9 must be superimposed on lines 0 and 1 as in Figure 4-1 B. Bit 0 of byte 0 and 1 must be set to a 1 in order to indicate the first two lines are to be displayed on lines 8 and 9. This forms a 8 x 8 matrix which must be programmed in the CGEN. Figure 4-1 C shows the HEX values that represent the letter j in memory.



ROW	DATA
0	49
1	39
2	08
3	00
4	08
5	08
6	08
7	08

Hex Data in Memory

C

CHARACTER GENERATOR ORGANIZATION

FIGURE 4-1

SECTION V

CONSTRUCTION

5-1 INTRODUCTION

The Video Display Board Kit is intended for those people who have had some prior experience with kit building and digital electronics. If you do not fall into this category it is highly recommended that you find an experienced person to help you in assembly and check out the board.

Appendix B shows the parts list for the Video Display Board. Double check all parts against this parts list.

NOTE: Assembly diagram and schematic diagram can be found in the Appendices.

5-2 ASSEMBLY PROCEDURE

1. Install the IC Sockets as follows:
   - A. 14 pin - U2,U11,U12,U19-U23,U27-U30,U32,U33,U37
   - B. 16 pin - U1,U7-U10,U13,U24,U26,U31,U36
   - C. 18 pin - U3-U6
   - D. 20 pin - U15,U25,U34,U35
   - E. 24 pin - U14,U16
   - F. 40 pin - U17,U18

R15

2. Install the resistors as follows:

   A. 100 Ohm 1/4W 5% (Brown,Black,Brown) - R1
   B. 220 Ohm 1/2W 5% (Red,Red,Brown) - R11
   C. 390 Ohm 1/4W 5% (Grey,Red,Brown) - R3, R4
   D. 1.5K Ohm 1/4W 5% (Brown,Green,Red) - R6
   E. 2.2K Ohm 1/4W 5% (Red,Red,Red) - R2,R5,R7-R10,R12
   F. 22K Ohm 1/4W 5% (Red,Red,Orange) - R8

more resistors

3. Install the capacitors as follows:

   A. 10pf - C3
   B. 200pf - C21
   C. 100pf - C4
   D. .1uf - C1,C2,C5-C10,C14-C17
   E. 10uf - C12,C13,C18-C20,C11

4. Install diodes with banded end as shown on PC board.

   CR1 1N751-5V
   CR2 1N914/1N4-148
   CR3, CR4 1N270

5. Install the voltage regulator with heat sink using the 6-32 hardware supplied.

   A. VR1 +5V 7805/LM340T-5
   B. VR2 +12V 7812/LM340K-12

6. Install transistor Q1-NPN 2N2222 or 2N3904.

7. Install the XTAL-14.43 MHz.

8. Double check all solder connections for cold solder joints, unsoldered connections and shorted connections.

5-3 VOLTAGE CHECK

1. Install the board in the computer and measure the output of +5V regulator VR1, -5V and +12V of CR1 and VR2 respectively.

   A. VR1 = +5V (Bottom Pin)
   B. CR1 = -5V (Anode)
   C. VR2 = +12V (Cathode)

2. Measure the power supply voltages in the Video Timer and Controller chip (any of the IC socket can be used.)

   A. ~~Pin 6 U16~~ = -5V U16 - pin 21
   B. ~~Pin 14 U16~~ = +5V U16 - pin 24
   C. Pin 13 ~~V16~~ = +12V U16 - pin 19

   NOTE: Do not proceed with board check out until all power supply voltages are correct. The TTL and MOS Logic can be permanently damaged if improper voltages are applied.

3. Install the IC's in their sockets observing the Pin 1 designation on each socket marked on the PC board.

A.	U11,U19	74LS00
B.	U2,U22,U27	74LS04
C.	U29	74LS10
D.	U32	74LS14
E.	U28	74LS20
F.	U20,U21,U33	7425
G.	U30,U37	74LS74
H.	U23	74LS86
I.	U12	74LS93
J.	U26	74LS139
K.	U31	74LS155
L.	U7,U8,U9,U10	74LS157
M.	U1	74LS163
N.	U24	74LS165
O.	U15,U25	74LS273
P.	U36	74LS368
Q.	U34	74LS373
R.	U35	74LS374
S.	U3,U4,U5,U6	2114
T.	U14,U16	2708 CGEN, 2708 VDB
U.	U17	Z80
V.	U18	CRT 5027

4. Double check all IC's for proper orientation and location.

SECTION VI

SOFTWARE AND INTERFACE

6-1 INTRODUCTION

This section will discuss the software needed to interface a CPU with the VDB. Also, the on-board software will be described such that it could be modified for special applications.

6-2 INTERFACE SOFTWARE

The VDB interfaces to the CPU using port 00_H for status and 01_H for data. The keyboard status is input on the second bit (bit 1) of port 00_H and the display status is input on the third bit (bit 2) of port 00_H.

The following sequence of instructions would need to be executed to poll the keyboard and input when data is available.

```
INPUT   IN      A,(00H)         ;READ KEYBOARD STATUS
        AND     02H
        JP      Z, INPUT        ;LOOP IF NOT READY
        IN      A, (01H)        ;INPUT KEYBOARD DATA
```

The following sequence of instructions would need to be executed to poll the output port and output a character from C-Register when the display is ready.

```
OUTPUT  IN      A,(00H)         ;INPUT DISPLAY STATUS
        AND     04H
        JP      Z, OUTPUT       ;LOOP IF NOT READY
        LD      A, C
        OUT     (01H), A        ;OUTPUT TO DISPLAY
```

6-3 PROCESSOR CONTROL SOFTWARE

The software that controls the display is stored in a PROM. This software recognizes the control word and executes a subroutine as a result of that control character. Thus, if a Line Feed Control character were output to the display, the software would compare the input to various characters and when it was found to be an OAH it would jump to the Line Feed subroutine.

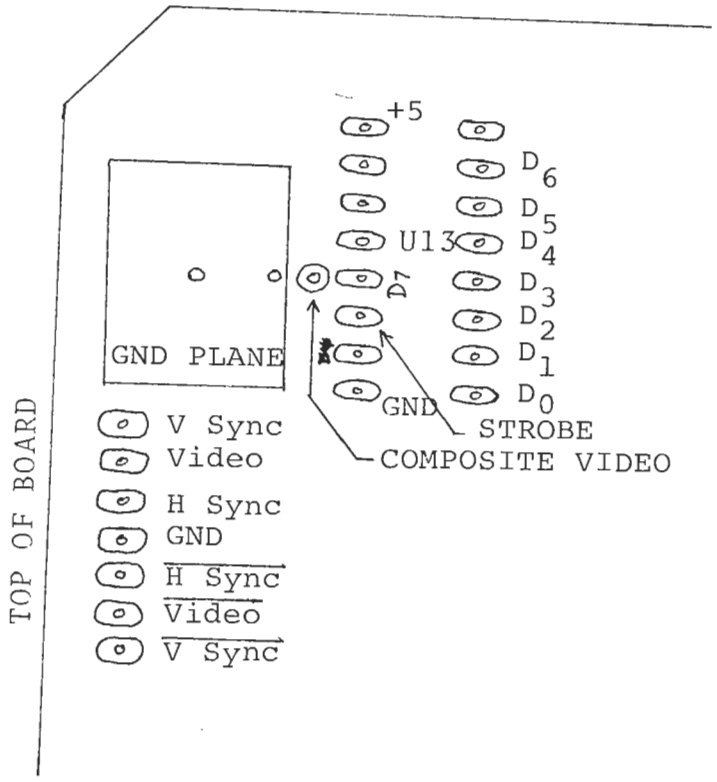
If a special function were needed it is possible to reprogram the PROM to accomplish the special function. Before reprogramming is attempted a complete understanding of how the board functions would be necessary to insure what is attempted would be possible.

6-4 KEYBOARD INPUT

The keyboard is interfaced through a DIP socket and can be connected with a ribbon cable and a 16 pin header. The pin out of the header U13 is shown in Figure 6-1. This header provides +5 Volts, GND, Strobe and D_0 through D_6.

6-5 MONITOR OUTPUT

The monitor output is either separate TTL level outputs or composite video output. The TTL levels are output on pins of header J2. Both positive true and negative true signals are brought out. The output positions are shown in Figure 6-1 and include vertical sync, horizontal sync, and video.



VDB INTERFACE SIGNALS

FIGURE 6-1

The composite video is brought out to J3 and can be interfaced in several different ways. Coaxial cable should be used to go from the board to a monitor. A space is provided for 2 pin berg headers to be used if needed.

SECTION VII

JUMPER OPTION SELECTION

7-1 INTRODUCTION

The VDB has been designed to provide the user with several selectable options. These options are initially hard wired on the board so the user does not need to install any jumpers unless he wishes to change an option.

7-2 CHARACTER GENERATOR

The character generator has jumpers on several voltage inputs to allow the use of either 2708, 2758 or 2716 PROMS. The board is initially wired for 2708. To change from 2708 to 2758 or 2716 the etch between E3 and E4 and the etch between E5 and E6 must be cut and jumpers installed between E1 and E3 and also between E2 and E10. Table 7-1 summarizes these connections.

NOTE: BOTH PROMS must be 2708 or 2758/2716.

E PROM	JUMPER	ETCH CUT
2708	E3-E9,E5-E6	None
2758	E3-E1,E5-E2	E3-E9
2716	E3-E1,E5-E11	E3-E4, E5-E6

TABLE 7-1

7-3 CURSOR TYPE CONTROL

Jumpers are available to select several different styles of cursors. These include reverse, underline, blinking underline, blinking reverse. Table 7-2 shows the jumper connection for each of these cursor types.

CURSOR TYPE	JUMPER
Reverse	None
Underline	E7-E8
Blinking Reverse	E9-E10
Blinking Underline	E7-E8, E9-E10

TABLE 7-2

NOTE: The P.C. Board comes with jumpers E7 to E8 and E9 to E10 installed and the etch must be cut if a different cursor type is needed.

7-4 SPECIAL CONTROL BITS

The special control bits can be used for any control purpose. For example: The first bit can be used for control of a 2716 to determine which half of the PROM the CGEN will be taken from. This is used to select between two different character sets such as a regular upper and lower case set and a set of APL characters. This would be accomplished by connecting jumper E11 to E7. The second bit can be used for other purposes such as a brightness control input to a monitor. This is output on jumper E12.

7-5 INTERRUPT MODE

When the VDB is used with the SBC-100 the vectored interrupts on pins 5 through 8 of the S-100 bus, can be used for priority interrupts. The keyboard can be used to interrupt the SBC-100 by jumpering E17 to one of E13 through E16 depending upon the priority needed.

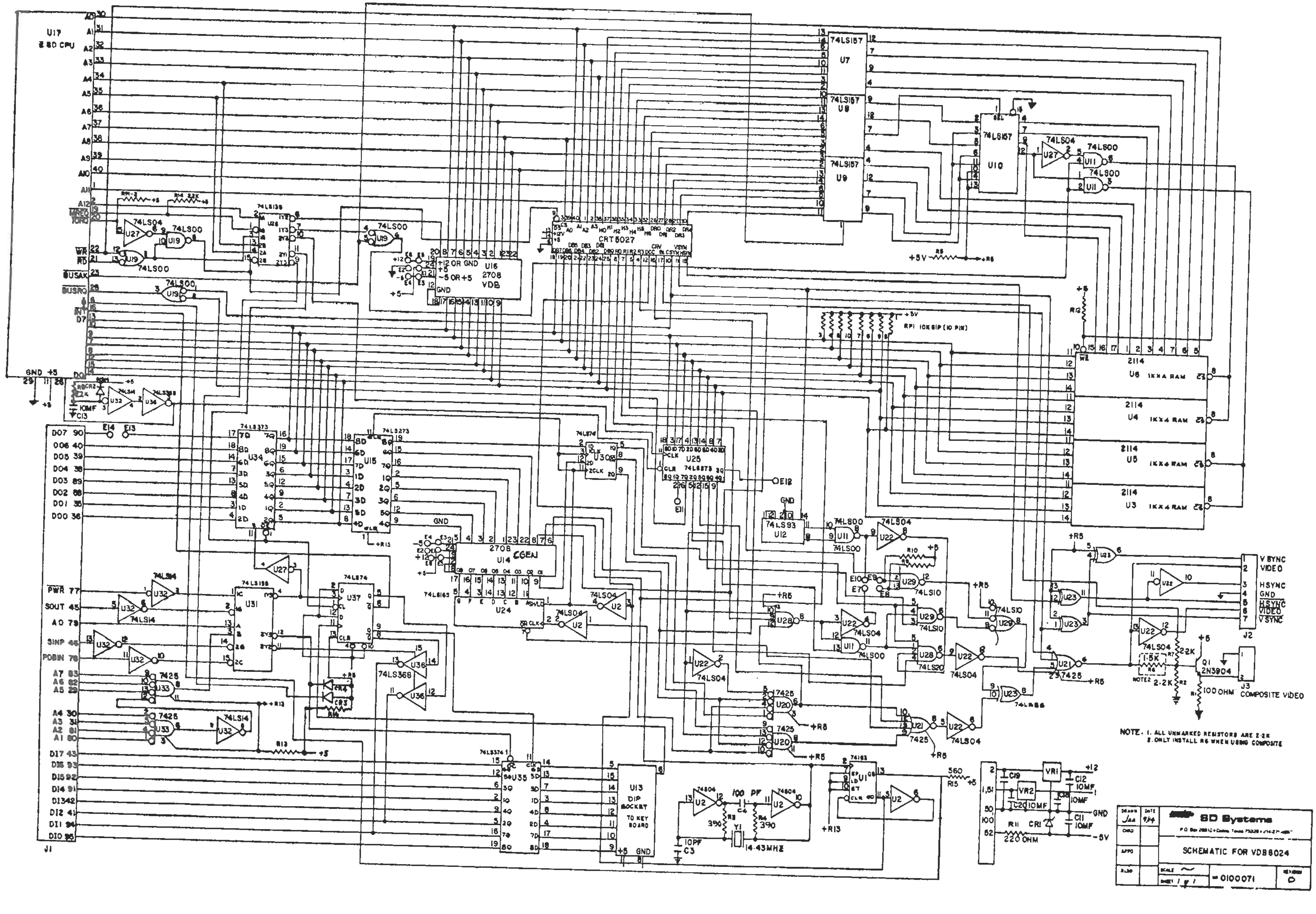
TP.

1-2	-5V	EPROM TYPE
3-4	+5V	
5-6	+12V	
7-8	Cursor	
9-10		
11,12	- output	
13-14	DO7	
15,16,17	interrupts.	

APPENDIX A

VDB 8024

SCHEMATIC DIAGRAM


SD Systems
SCHEMATIC FOR VDB8024
0100071
D
NOTE. 1. ALL UNMARKED RESISTORS ARE 2.2K
2. ONLY INSTALL R6 WHEN USING COMPOSITE
U17
Z80 CPU
CRT5027
U16
2708
VDB
2708 CGEN
U14
2114
1KX4 RAM
U13
DIP SOCKET
TO KEY BOARD
J1
J2
V SYNC
VIDEO
HSYNC
GND
J3
COMPOSITE VIDEO
14.43MHZ
2N3904
100 OHM
220 OHM
RP1 10K SIP (10 PIN)

APPENDIX B

VIDEO DISPLAY BOARD

PARTS LIST

SD Systems

P.O. Box 28810 • Dallas, Texas 75228 214-271-4667

BILL OF MATERIALS

Title:	PL No.	Rev.
VIDEO DISPLAY BOARD	0100070	D

Date Released:	Approved:	Sheet 1 Of 3
8-15-78		

Item no	Qty	SD-P/N	Description	Unit Cost	Extension
1	2	7010160	74LS00, U11, U19		
2	2	7010164	74LS04, U22, U27		
3	1	7010336	74S04, U2		
4	1	7010168	74LS10, U29		
5	1	7010172	74LS14, U32		
6	1	7010174	74LS20, U28		
7	3	7010022	7425, U20, U21, U33		
8	2	7010195	74LS74, U30, U37		
9	1	7010201	74LS86, U23		
10	1	7010205	74LS93, U12		
11	1	7010220	74LS139, U26		
12	1	7010226	74LS155, U31		
13	4	7010228	74LS157, U7, U8, U9, U10		
14	1	7010099	74163, U1		
15	1	7010235	74LS165, U24		
16	2	7010276	74LS273, U15, U25		
17	1	7010303	74LS368, U36		
18	1	7010304	74LS373, U34		
19	1	7010305	74LS374, U35		
20	4	7010321	2114, U3, U4, U5, U6		
21					
22	1	7010334	3880-4 (Z80A), U17		
23	1	7010355	CRT 5027, U18		
24	1	7000010	PC Board ARTWORK # 0100072		

SD Systems

P.O. Box 28810 • Dallas, Texas 75228 214-271-4667

BILL OF MATERIALS

Title:	PL No.	Rev.
VIDEO DISPLAY BOARD	0100070	D

Date Released:	Approved:	Sheet 2	Of 3
8-15-78			

Item no	Qty	SD-P/N	Description	Unit Cost	Extension
25	1	7080005	14.43098 MH Crystal		
26	9	7020081	2.2K 1/4W, R2,R5,R7, R9, R10, R12-R14, R16		
27	1	7020077	1.5K 1/4 Watt, R6		
28	1	7020049	100 Ohm 1/4 Watt, R1		
29	1	7020177	220 Ohm, 1/2 Watt, R11		
30	1	7020067	560 Ohm 1/4 Watt, R15		
31	12	7030007	.1 uf, C1,C2,C5-C10,C14-C17		
32	6	7030009	10 uf, C12,C13,C18,C19,C20,C11		
[illegible]	1	7030001	10 pf, C3		
34	1	7030004	100 pf MICA C4		
35	1	7030005	200 pf, C21		
36	1	7160002	LM323K 5V-3A Regulator		
37	1	7160003	7812/LM340T-12.0, 12V-1A Regulator		
38	1	7040003	1N-751, 5V Zener, CR1		
39	1	7130026	Heat Sink, 6051 , Thermalloy		
40	3	7130006	Screw, 6-32 x 3/8 PPH		
41	3	7130007	Nut, 6-32		
42	1	7040010	2N3904, NPN Transistor		
43	1	7170012	4-Pin Berg Connector		
44	2	7060009	40-Pin Socket		
45	2	7060007	24-Pin Socket		
[illegible]	4	7060005	20-Pin Socket		
47	4	7060004	18-Pin Socket		
48	10	7060003	16-Pin Socket		

SD Systems

P.O. Box 28810 • Dallas, Texas 75228 214-271-4667

BILL OF MATERIALS

Title:	PL No.	Rev.
VIDEO DISPLAY BOARD	0100070	D

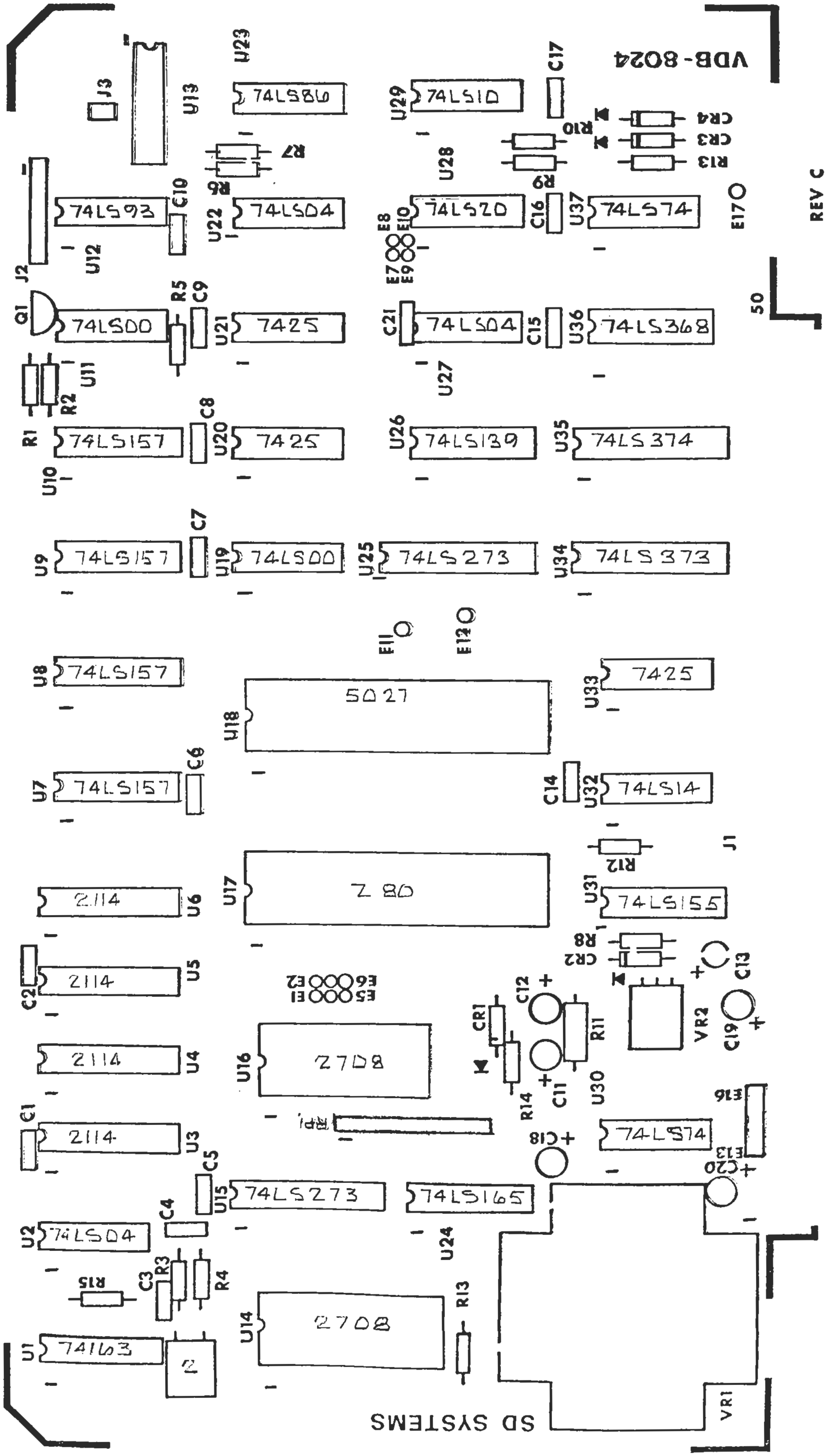
Date Released:	Approved:	Sheet 3	Of 3
8-15-78			

Item no	Qty	SD-P/N	Description	Unit Cost	Extension
49	15	7060002	14-Pin Socket		
50	1	7010347	Resistor SIP, 10K, 10 Pin, RP1		
51	1	7040001	Diode, 1N914, CR2		
52	1	7020105	Resistor, 22K, R8		
53	2	7040011	DIODE 1N270 CR3&4 GERMANIUM		
54	2	7020063	RESISTOR 390 OHMS 1/4W R3, R4		
55	1	7010360	VDB CONTROL SOFTWARE(2708) U16 (60HZ)OPTION		
	1	7010365	VDB CONTROL SOFTWARE(2708) U16 (50HZ) OPTION		
56	1	7010361	CGEN CHARACTER GENERATOR 2708 U14.		

APPENDIX C

VDB 8024

PARTS PLACEMENT DIAGRAM


VDB-8024
REV C
SD SYSTEMS
74LS86
74LS10
74LS93
74LS04
74LS20
74LS74
74LS00
7425
74LS04
74LS368
74LS157
7425
74LS139
74LS374
74LS157
74LS00
74LS273
74LS373
74LS157
5027
7425
74LS157
74LS14
2114
Z 80
74LS155
2114
2114
2708
2114
74LS74
74LS273
74LS165
74LS04
74163
2708

APPENDIX D

VDB 8024

ONBOARD SOFTWARE

```
VDB     COPYRIGHT 1978 SD SYSTEMS       SD SYSTEMS Z80 ASSEMBLER PAGE 0001
 ADDR   CODE      STMT SOURCE STATEMENT

                 0002          NAME    VDB
                 0003 ;
                 0004 ;
                 0005 ;        VIDEO DISPLAY BOARD CONTROL SOFTWARE
                 0006 ;        VERSION 1.6     2/14/79
                 0007 ;
                 0008 ;        VERSION 1.6 ADDED THE CURSOR HOME CONTROL
                 0009 ;        FUNCTION
                 0010 ;
                 0011 ; POWER UP INITIALIZATION
                 0012 ;
                 0013 ;
 >0000           0014          ORG 00
'0000  310020    0015          LD SP,2000H
'0003  DB20      0016          IN      A,(20H) ; CLEAR INTERRUPT FLOP
'0005  DB30      0017          IN A,(30H)      ; CLEAR KEYBOARD RDY FLOP
'0007  D9        0018          EXX
'0008  2E00      0019          LD      L,0
'000A  D9        0020          EXX
'000B  CDFF00'   0021          CALL INIT
'000E  CDCF01'   0022          CALL CLEAR
'0011  CDFE02'   0023          CALL FAST
'0014  CD2C03'   0024          CALL    STDN
'0017  210010    0025          LD HL,1000H     ; DISPLAY MEMORY STARTING ADDRESS
'001A  ED56      0026          IM 1
'001C  37        0027          SCF
'001D  FB        0028          EI
'001E  76        0029          HALT
                 0030 ;
                 0031 ;
                 0032 ; START OF INTERUPT DRIVEN PROGRAM
                 0033 ;
                 0034 ;
 >0038           0035          ORG 38H
'0038  D0        0036          RET NC          ; RETURN ON NO CARRY
'0039  FDE1      0037          POP IY
'003B  D9        0038          EXX
'003C  CB7D      0039          BIT     7,L
'003E  D9        0040          EXX
'003F  DB20      0041          IN A,(20H)      ; INPUT CHARACTER
'0041  CBBF      0042          RES     7,A
'0043  2802      0043          JR      Z,NEXT-$
'0045  F680      0044          OR      80H
'0047  CB77      0045 NEXT     BIT     6,A     ; TEST FOR CONTROL CHARACTER
'0049  C25100'   0046          JP NZ,TDIS
'004C  CB6F      0047          BIT 5,A
'004E  CA6600'   0048          JP Z,CTR
'0051  CDE302'   0049 TDIS     CALL DELAY
'0054  CD0503'   0050          CALL PROTECT
                 0051 ;
                 0052 ;
                 0053 ; DISPLAY CHARACTER
                 0054 ;
                 0055 ;
'0057  77        0056 DISPLAY LD (HL),A       ; MOVE CHARACTER TO DISPLAY M  OR
'0058  14        0057 NODIS   INC D
'0059  3E50      0058 CHECK   LD A,80
'005B  BA        0059          CP D           ; CHECK FOR END OF LINE
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

'005C  CA2E01'  0060         JP Z,LFCR
'005F  23       0061         INC HL
'0060  7A       0062         LD A,D
'0061  D38C     0063         OUT (8CH),A      ; MOVE CURSOR TO NEXT SPACE
'0063  37       0064         SCF
'0064  FB       0065         EI
'0065  76       0066         HALT
               0067 ;
               0068 ;
               0069 ; BRANCH ON CONTROL CHARACTERS
               0070 ;
               0071 ;
'0066  FD213401' 0072 CTR     LD IY,HLT
'006A  FDE5     0073         PUSH IY          ; PUSH RETURN ADDRESS
'006C  CBBF     0074         RES 7,A
'006E  FE0A     0075         CP 0AH           ; LINE FEED
'0070  CA3701'  0076         JP Z,LF
'0073  FE0D     0077         CP 0DH           ; CARRIAGE RETURN
'0075  CA6A01'  0078         JP Z,CR
'0078  FE01     0079         CP 01H           ; SCROLL UP
'007A  CA2C03'  0080         JP Z,STDN
'007D  FE02     0081         CP 02H           ; SCROLL DOWN
'007F  CA2703'  0082         JP Z,STUP
'0082  FE03     0083         CP 03H           ; SPECIAL CHARACTER
'0084  CAB002'  0084         JP Z,SPCH
'0087  FE04     0085         CP 04H           ; SET CONTROL BIT #1
'0089  CAC702'  0086         JP Z,SC1
'008C  FE05     0087         CP 05H           ; RESET CONTROL BIT #1
'008E  CACE02'  0088         JP Z,RC1
'0091  FE06     0089         CP 06H           ; SET CONTROL BIT #2
'0093  CAD502'  0090         JP Z,SC2
'0096  FE07     0091         CP 07H           ; RESET CONTROL BIT #2
'0098  CADC02'  0092         JP Z,RC2
'009B  FE08     0093         CP 08H           ; BACK SPACE
'009D  CA7401'  0094         JP Z,CTRH
'00A0  FE09     0095         CP 09H           ; TAB MODULO EIGHT
'00A2  CA6102'  0096         JP Z,TAB
'00A5  FE0B     0097         CP 0BH           ; MOVE UP ONE LINE
'00A7  CAF701'  0098         JP Z,UPLINE
'00AA  FE0C     0099         CP 0CH           ; NONDESTRUCTIVE FORWARD SPACE
'00AC  CA1402'  0100         JP Z,RIGHT
'00AF  FE0E     0101         CP 0EH           ; SLOW DISPLAY SPEED
'00B1  CAF002'  0102         JP Z,SLOW
'00B4  FE0F     0103         CP 0FH           ; MEDIUM DISPLAY SPEED
'00B6  CAF702'  0104         JP Z,MED
'00B9  FE10     0105         CP 10H           ; FAST DISPLAY SPEED
'00BB  CAFE02'  0106         JP Z,FAST
'00BE  FE11     0107         CP 11H           ; QUIT STOPS REVERSE FIELD
'00C0  CA9802'  0108         JP Z,QUIT
'00C3  FE12     0109         CP 12H           ; STARTS REVERSE FIELD
'00C5  CA7A02'  0110         JP Z,RVS
'00C8  FE13     0111         CP 13H           ; STARTS REVERSE BLINKING FIELD
'00CA  CA8402'  0112         JP Z,RVB
'00CD  FE14     0113         CP 14H           ; STARTS BLINKING FIELD
'00CF  CA7002'  0114         JP Z,BLINK
'00D2  FE15     0115         CP 15H           ; STARTS UNDERLINE FIELD
'00D4  CA8E02'  0116         JP Z,UND
'00D7  FE16     0117         CP 16H           ; STARTS UNDERLINE BLINKING FIEL
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

'00D9  CAA302'  0118         JP Z,UNB
'00DC  FE17     0119         CP 17H          ; STARTS NO ENHANCEMENT OR PROTEC
'00DE  CA1203'  0120         JP Z,NFD
'00E1  FE18     0121         CP 18H          ; ENTER PROTECT MODE
'00E3  CA1D03'  0122         JP Z,PFD
'00E6  FE19     0123         CP 19H          ; EXIT PROTECT MODE
'00E8  CA2203'  0124         JP Z,UNPFD
'00EB  FE1A     0125         CP 1AH          ; CLEAR PAGE
'00ED  CACF01'  0126         JP Z,CLEAR
'00F0  FE1B     0127         CP 1BH          ; ESC=YX CURSOR PLACEMENT
'00F2  CA2A02'  0128         JP Z,ESC
'00F5  FE1E     0129         CP 1EH          ; HOME
'00F7  CA1A02'  0130         JP Z,HOME
'00FA  FDE1     0131         POP IY
'00FC  C35700'  0132         JP DISPLAY
                0133 ;
                0134 ;
                0135 ; INITIALIZE CRT 5027
                0136 ;
                0137 ;
'00FF  D38A     0138 INIT    OUT (8AH),A
'0101  3E65     0139         LD A,065H
'0103  D380     0140         OUT (80H),A
'0105  3E4B     0141         LD A,04BH
'0107  D381     0142         OUT (81H),A
'0109  3E4D     0143         LD A,04DH
'010B  D382     0144         OUT (82H),A
'010D  3ED7     0145         LD A,0D7H
'010F  D383     0146         OUT (83H),A
'0111  3E03     0147         LD      A,003H  ; 60HZ = 03H, 50HZ = 1DH
'0113  D384     0148         OUT (84H),A
'0115  3E0B     0149         LD      A,0BH   ; 60HZ = 0BH, 50HZ = 25H
'0117  D385     0150         OUT (85H),A
'0119  3E17     0151         LD A,23
'011B  47       0152         LD B,A
'011C  D386     0153         OUT (86H),A
'011E  3E00     0154         LD A,00
'0120  D38C     0155         OUT (8CH),A
'0122  D38D     0156         OUT (8DH),A
'0124  D38E     0157         OUT (8EH),A
'0126  D38A     0158         OUT (8AH),A
'0128  D38E     0159         OUT (8EH),A
'012A  110000   0160         LD DE,0000
'012D  C9       0161         RET
'012E  CD3701'  0162 LFCR    CALL LF
'0131  CD6A01'  0163         CALL CR
'0134  37       0164 HLT     SCF             ; RETURN POINT FROM CONTROLS
'0135  FB       0165         EI
'0136  76       0166         HALT
                0167 ;
                0168 ;
                0169 ; LINE FEED
                0170 ;
                0171 ;
'0137  D9       0172 LF      EXX
'0138  CB4D     0173         BIT 1,L         ; TEST FOR SCROLL DIRECTION
'013A  D9       0174         EXX
'013B  CA4F01'  0175         JP Z,LFDN
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

'013E  7B        0176 LFUP    LD A,E
'013F  3D        0177         DEC A
'0140  FEFF      0178         CP 0FFH
'0142  C24701'   0179         JP NZ,LFCS
'0145  3E17      0180         LD A,23
'0147  B8        0181 LFCS    CP B
'0148  5F        0182         LD E,A
'0149  CC8B01'   0183         CALL Z,SCRDN
'014C  C35C01'   0184         JP LFRT
'014F  7B        0185 LFDN    LD A,E
'0150  B8        0186         CP B
'0151  CCAD01'   0187         CALL Z,SCRUP
'0154  3C        0188         INC A
'0155  FE18      0189         CP 24
'0157  C25C01'   0190         JP NZ,LFRT
'015A  3E00      0191         LD A,00
                 0192 ;
                 0193 ;
                 0194 ; IN SCROLL DOWN MODE LINE FEED MOVES CURSOR UP
                 0195 ;
                 0196 ;
'015C  5F        0197 LFRT    LD E,A          ; REG E CONTAINS LINE NUMBER
'015D  D38D      0198         OUT (8DH),A
'015F  6A        0199         LD L,D
'0160  63        0200         LD H,E
'0161  CB15      0201         RL L
'0163  CB1C      0202         RR H
'0165  CB1D      0203         RR L
'0167  CBE4      0204         SET 4,H
'0169  C9        0205         RET
'016A  1600      0206 CR      LD D,00
'016C  7A        0207         LD A,D
'016D  D38C      0208         OUT (8CH),A
'016F  3E80      0209         LD A,80H
'0171  A5        0210         AND L
'0172  6F        0211         LD L,A
'0173  C9        0212         RET
'0174  3E00      0213 CTRH    LD A,00
'0176  BA        0214         CP D
'0177  C8        0215         RET Z
'0178  15        0216         DEC D
'0179  2B        0217         DEC HL
'017A  7A        0218         LD A,D
'017B  D38C      0219         OUT (8CH),A
'017D  C9        0220         RET
'017E  CD8401'   0221 SCRL    CALL SCROLL
'0181  C30302'   0222         JP PLACE
'0184  D9        0223 SCROLL  EXX
'0185  CB4D      0224         BIT 1,L
'0187  D9        0225         EXX
'0188  CAAD01'   0226         JP Z,SCRUP
                 0227 ;
                 0228 ;
                 0229 ; SCROLL DOWN MODE
                 0230 ;
                 0231 ;
'018B  05        0232 SCRDN   DEC B
'018C  78        0233         LD A,B
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

'018D  FEFF      0234         CP 0FFH
'018F  C29401'   0235         JP NZ,SCRD2
'0192  0617      0236         LD B,23
'0194  2E00      0237 SCRD2   LD L,00
'0196  60        0238         LD H,B
'0197  CB1C      0239         RR H
'0199  CB1D      0240         RR L
'019B  CBE4      0241         SET 4,H
'019D  0E20      0242         LD C,20H
'019F  3E80      0243         LD A,80H
'01A1  85        0244         ADD A,L
'01A2  71        0245 SCRDLP  LD (HL),C
'01A3  23        0246         INC HL
'01A4  BD        0247         CP L
'01A5  C2A201'   0248         JP NZ,SCRDLP
'01A8  78        0249         LD A,B
'01A9  D386      0250         OUT (86H),A
'01AB  7B        0251         LD A,E
'01AC  C9        0252         RET
                 0253 ;
                 0254 ;
                 0255 ; SCROLL UP MODE
                 0256 ;
                 0257 ;
'01AD  04        0258 SCRUP   INC B
'01AE  78        0259         LD A,B
'01AF  FE18      0260         CP 24
'01B1  C2B601'   0261         JP NZ,SCR2
'01B4  0600      0262         LD B,00
'01B6  2E00      0263 SCR2    LD L,00
'01B8  60        0264         LD H,B
'01B9  CB1C      0265         RR H
'01BB  CB1D      0266         RR L
'01BD  CBE4      0267         SET 4,H
'01BF  0E20      0268         LD C,20H
'01C1  3E50      0269         LD A,80
'01C3  85        0270         ADD A,L
'01C4  71        0271 SCRLP   LD (HL),C
'01C5  23        0272         INC HL
'01C6  BD        0273         CP L
'01C7  C2C401'   0274         JP NZ,SCRLP
'01CA  78        0275         LD A,B
'01CB  D386      0276         OUT (86H),A
'01CD  7B        0277         LD A,E
'01CE  C9        0278         RET
                 0279 ;
                 0280 ;
                 0281 ;
                 0282 ; FILL SCREEN WITH BLANK CHARACTERS
                 0283 ;
                 0284 ;
'01CF  3E08      0285 CLEAR   LD A,08H
'01D1  D310      0286         OUT (10H),A
'01D3  210010    0287         LD HL,1000H
'01D6  0E20      0288         LD C,20H
'01D8  3E50      0289 CLR1    LD A,50H
'01DA  71        0290 CLR     LD (HL),C
'01DB  23        0291         INC HL
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

'01DC  BD        0292         CP L
'01DD  C2DA01'   0293         JP NZ,CLR
'01E0  3ED0      0294         LD A,0D0H
'01E2  71        0295 CLR2    LD (HL),C
'01E3  23        0296         INC HL
'01E4  BD        0297         CP L
'01E5  C2E201'   0298         JP NZ,CLR2
'01E8  3E1B      0299         LD A,1BH
'01EA  BC        0300         CP H
'01EB  C2D801'   0301         JP NZ,CLR1
'01EE  CD1A02'   0302         CALL HOME
'01F1  3E20      0303         LD A,20H
'01F3  D310      0304         OUT (10H),A
'01F5  08        0305         EX AF,AF'
'01F6  C9        0306         RET
                 0307 ;
                 0308 ;
                 0309 ; MOVE CURSOR UP ONE LINE
                 0310 ;
                 0311 ;
'01F7  7B        0312 UPLINE  LD A,E
'01F8  FE00      0313         CP 00H
'01FA  C2FF01'   0314         JP NZ,UPLP
'01FD  3E18      0315         LD A,24
'01FF  3D        0316 UPLP    DEC A
'0200  B8        0317         CP B
'0201  C8        0318         RET Z
'0202  5F        0319         LD E,A
                 0320 ;
                 0321 ;
                 0322 ; PLACES CURSOR AT POSITION SPECIFIED IN REG D AND E
                 0323 ;
                 0324 ;
'0203  63        0325 PLACE   LD H,E
'0204  6A        0326         LD L,D
'0205  CB15      0327         RL L
'0207  CB1C      0328         RR H
'0209  CB1D      0329         RR L
'020B  CBE4      0330         SET 4,H
'020D  7A        0331         LD A,D
'020E  D38C      0332         OUT (8CH),A
'0210  7B        0333         LD A,E
'0211  D38D      0334         OUT (8DH),A
'0213  C9        0335         RET
'0214  14        0336 RIGHT   INC D
'0215  DDE1      0337         POP IX
'0217  C35900'   0338         JP CHECK
'021A  1600      0339 HOME    LD D,00
'021C  78        0340         LD A,B
'021D  3C        0341         INC A
'021E  FE18      0342         CP 24
'0220  C22502'   0343         JP NZ,HOLP
'0223  3E00      0344         LD A,00
'0225  5F        0345 HOLP    LD E,A
'0226  CD0302'   0346         CALL PLACE
'0229  C9        0347         RET
                 0348 ;
                 0349 ;
```

```
 ADDR  CODE       STMT SOURCE STATEMENT

                  0350 ; CURSOR PLACEMENT OF ESC=YX
                  0351 ;
                  0352 ;
'022A  37         0353 ESC     SCF
'022B  3F         0354         CCF              ; CLEAR CARRY FLAG WILL CAUSE
'022C  FB         0355         EI               ; RETURN AFTER INTERUPT
'022D  76         0356         HALT
'022E  DB20       0357         IN A,(20H)       ; INPUT CHARACTER
'0230  CBBF       0358         RES 7,A
'0232  FE3D       0359         CP 3DH           ; TEST FOR "="
'0234  C0         0360         RET NZ
'0235  37         0361         SCF
'0236  3F         0362         CCF
'0237  FB         0363         EI
'0238  76         0364         HALT
'0239  DB20       0365         IN A,(20H)       ; INPUT Y VALUE
'023B  CBBF       0366         RES 7,A
'023D  D620       0367         SUB 20H
'023F  F8         0368         RET M
'0240  FE18       0369         CP 24            ; TEST FOR VALUE > 24
'0242  F0         0370         RET P
'0243  80         0371         ADD      A,B
'0244  3C         0372         INC      A
'0245  FE18       0373         CP       24
'0247  FA4C02'    0374         JP       M,ESLP
'024A  D618       0375         SUB      24
'024C  4F         0376 ESLP    LD       C,A
'024D  37         0377         SCF
'024E  3F         0378         CCF
'024F  FB         0379         EI
'0250  76         0380         HALT
'0251  DB20       0381         IN       A,(20H) ; INPUT X VALUE
'0253  CBBF       0382         RES      7,A
'0255  D620       0383         SUB      20H
'0257  F8         0384         RET      M
'0258  FE50       0385         CP       80      ; TEST FOR VALUE > 80
'025A  F0         0386         RET      P
'025B  59         0387         LD       E,C
'025C  57         0388         LD       D,A
'025D  CD0302'    0389         CALL PLACE       ; PLACE CURSOR AT NEW POSITION
'0260  C9         0390         RET
                  0391 ;
                  0392 ;
                  0393 ; TAB SET EVERY 8 SPACES
                  0394 ;
                  0395 ;
'0261  3EF8       0396 TAB     LD A,0F8H
'0263  A2         0397         AND D
'0264  C608       0398         ADD A,08H
'0266  FE50       0399         CP 80
'0268  CA6F02'    0400         JP Z,TED
'026B  57         0401         LD D,A
'026C  CD0302'    0402         CALL PLACE
'026F  C9         0403 TED     RET
                  0404 ;
                  0405 ;
                  0406 ; AF' REG CONTAINS SPECIAL CONTROL STATUS
                  0407 ; ENHANCEMENT FUNCTION CONTROLLED THROUGH PORT 10H
```

```
 ADDR  CODE      STMT SOURCE STATEMENT

                 0408 ;
                 0409 ;
                 0410 ; BIT 7 CONTROLS ENHANCEMENT FIELD
                 0411 ; BIT 6 CONTROLS SPECIAL BIT #1
                 0412 ; BIT 5 CONTROLS RUNNING TIME
                 0413 ; BIT 4 CONTROLS UNDERLINE
                 0414 ; BIT 3 CONTROLS BLANKING
                 0415 ; BIT 2 CONTROLS REVERSE
                 0416 ; BIT 1 CONTROLS BLINKING
                 0417 ; BIT 0 CONTROLS SPECIAL BIT #2
                 0418 ;
                 0419 ;
'0270  08        0420 BLINK   EX AF,AF'
'0271  E669      0421         AND 69H
'0273  F622      0422         OR  22H
'0275  D310      0423         OUT (10H),A
'0277  08        0424         EX AF,AF'
'0278  1831      0425         JR      ENHANC-$
'027A  08        0426 RVS     EX AF,AF'
'027B  E669      0427         AND 69H
'027D  F624      0428         OR  24H
'027F  D310      0429         OUT (10H),A
'0281  08        0430         EX AF,AF'
'0282  1827      0431         JR      ENHANC-$
'0284  08        0432 RVB     EX AF,AF'
'0285  E669      0433         AND 69H
'0287  F626      0434         OR  26H
'0289  D310      0435         OUT (10H),A
'028B  08        0436         EX AF,AF'
'028C  181D      0437         JR      ENHANC-$
'028E  08        0438 UND     EX AF,AF'
'028F  E669      0439         AND 69H
'0291  F634      0440         OR  34H
'0293  D310      0441         OUT (10H),A
'0295  08        0442         EX AF,AF'
'0296  1813      0443         JR      ENHANC-$
'0298  08        0444 QUIT    EX AF,AF'
'0299  CBBF      0445         RES 7,A
'029B  D310      0446         OUT (10H),A
'029D  08        0447         EX AF,AF'
'029E  D9        0448 QUIT1   EXX
'029F  CBBD      0449         RES     7,L
'02A1  D9        0450         EXX
'02A2  C9        0451         RET
'02A3  08        0452 UNB     EX AF,AF'
'02A4  E669      0453         AND 69H
'02A6  F636      0454         OR  36H
'02A8  D310      0455         OUT (10H),A
'02AA  08        0456         EX AF,AF'
'02AB  D9        0457 ENHANC  EXX
'02AC  CBFD      0458         SET     7,L
'02AE  D9        0459         EXX
'02AF  C9        0460         RET
                 0461 ;
                 0462 ;
                 0463 ; SPECIAL CHARACTER FUNCTION
                 0464 ;
                 0465 ;
```

```
 ADDR  CODE       STMT SOURCE STATEMENT

'02B0  37         0466 SPCH    SCF
'02B1  3F         0467         CCF
'02B2  FB         0468         EI
'02B3  76         0469         HALT
'02B4  DB20       0470         IN A,(20H)       ; INPUT SPECIAL CHARACTER
'02B6  CBBF       0471         RES 7,A
'02B8  D640       0472         SUB 40H
'02BA  F8         0473         RET M
'02BB  FDE1       0474         POP IY
'02BD  FE20       0475         CP 20H
'02BF  FA5100'    0476         JP M,TDIS
'02C2  D620       0477         SUB 20H
'02C4  C35100'    0478         JP TDIS
                  0479 ;
                  0480 ;
                  0481 ; SETTING AND RESETTING OF CONTROL BITS
                  0482 ;
                  0483 ;
'02C7  08         0484 SC1     EX AF,AF'
'02C8  CBF7       0485         SET 6,A
'02CA  D310       0486         OUT (10H),A
'02CC  08         0487         EX AF,AF'
'02CD  C9         0488         RET
'02CE  08         0489 RC1     EX AF,AF'
'02CF  CBB7       0490         RES 6,A
'02D1  D310       0491         OUT (10H),A
'02D3  08         0492         EX AF,AF'
'02D4  C9         0493         RET
'02D5  08         0494 SC2     EX AF,AF'
'02D6  CBC7       0495         SET 0,A
'02D8  D310       0496         OUT (10H),A
'02DA  08         0497         EX AF,AF'
'02DB  C9         0498         RET
'02DC  08         0499 RC2     EX AF,AF'
'02DD  CB87       0500         RES 0,A
'02DF  D310       0501         OUT (10H),A
'02E1  08         0502         EX AF,AF'
'02E2  C9         0503         RET
                  0504 ;
                  0505 ;
                  0506 ; SOFTWARE DELAY LOOP
                  0507 ;
                  0508 ;
'02E3  D9         0509 DELAY   EXX
'02E4  D5         0510         PUSH DE
'02E5  15         0511 DLP     DEC D
'02E6  C2E502'    0512         JP NZ,DLP
'02E9  1D         0513         DEC E
'02EA  C2E502'    0514         JP NZ,DLP
'02ED  D1         0515         POP DE
'02EE  D9         0516         EXX
'02EF  C9         0517         RET
                  0518 ;
                  0519 ;
                  0520 ; SET DISPLAY SPEED
                  0521 ;
                  0522 ;
'02F0  D9         0523 SLOW    EXX
```

```
VDB     COPYRIGHT 1978 SD SYSTEMS       SD SYSTEMS Z80 ASSEMBLER PAGE 0010
 ADDR   CODE      STMT SOURCE STATEMENT

'02F1   16FF      0524          LD D,0FFH       ; REG D' AND E' CONTAIN DELAY
'02F3   1E01      0525          LD E,01H
'02F5   D9        0526          EXX
'02F6   C9        0527          RET
'02F7   D9        0528 MED      EXX
'02F8   165F      0529          LD D,05FH
'02FA   1E01      0530          LD E,01H
'02FC   D9        0531          EXX
'02FD   C9        0532          RET
'02FE   D9        0533 FAST     EXX
'02FF   1601      0534          LD D,01H
'0301   1E01      0535          LD E,01H
'0303   D9        0536          EXX
'0304   C9        0537          RET
                  0538 ;
                  0539 ;
                  0540 ; PROTECTED FIELD MODE
                  0541 ;
                  0542 ;
'0305   D9        0543 PROTECT  EXX
'0306   CB45      0544          BIT 0,L         ; BIT 0 OF REG L' SETS PROTECT M
'0308   D9        0545          EXX
'0309   C8        0546          RET Z
'030A   CB7E      0547          BIT 7,(HL)      ; BIT 7 OF MEMORY IS PROTECT BIT
'030C   C8        0548          RET Z
'030D   FDE1      0549          POP IY
'030F   C35800'   0550          JP NODIS
'0312   08        0551 NFD      EX AF,AF'
'0313   E669      0552          AND 69H
'0315   CBFF      0553          SET 7,A
'0317   D310      0554          OUT (10H),A
'0319   08        0555          EX AF,AF'
'031A   C39E02'   0556          JP      QUIT1
'031D   D9        0557 PFD      EXX
'031E   CBC5      0558          SET 0,L
'0320   D9        0559          EXX
'0321   C9        0560          RET
'0322   D9        0561 UNPFD    EXX
'0323   CB85      0562          RES 0,L
'0325   D9        0563          EXX
'0326   C9        0564          RET
                  0565 ;
                  0566 ;
                  0567 ; SET SCROLL MODE
                  0568 ;
                  0569 ;
'0327   D9        0570 STUP     EXX
'0328   CBCD      0571          SET 1,L
'032A   D9        0572          EXX
'032B   C9        0573          RET
'032C   D9        0574 STDN     EXX
'032D   CB8D      0575          RES 1,L
'032F   D9        0576          EXX
'0330   C9        0577          RET
```

APPENDIX E

VDB 8024

CHARACTER GENERATOR DATA

```
 ADDR   CODE      STMT SOURCE STATEMENT

                  0001 ;
                  0002 ;
                  0003 ;       CHARACTER GENERATOR SOFTWARE
                  0004 ;       VERSION 1.0     09/01/78/    KCG
                  0005 ;
                  0006 ;
 >0000            0007         ORG 00H
'0000  00000000   0008         DEFB 00,00,00,00,76H,88H,88H,76H
       76888876
'0008  81384444   0009         DEFB 81H,38H,44H,44H,78H,44H,44H,78H
       78444478
'0010  00E21418   0010         DEFB 00,0E2H,14H,18H,28H,28H,28H,10Hx
       28282810
'0018  003C4020   0011         DEFB 00,3CH,40H,20H,30H,48H,84H,78H
       30488478
'0020  0000003C   0012         DEFB 00,00,00,3CH,40H,0FCH,40H,3CH
       40FC403C
'0028  00384482   0013         DEFB 00,38H,44H,82H,0FEH,82H,44H,38H
       FE824438
'0030  00000000   0014         DEFB 00,00,00,00,20H,20H,28H,10H
       20202810
'0038  00804020   0015         DEFB 00,80H,40H,20H,10H,28H,44H,82H
       10284482
'0040  81000000   0016         DEFB 081H,00,00,00,22H,22H,22H,5CH
       2222225C
'0048  00000000   0017         DEFB 00,00,00,00,0E2H,22H,24H,38H
       E2222438
'0050  00000000   0018         DEFB 00,00,00,00,7EH,0A4H,24H,24H
       7EA42424
'0058  00FC4020   0019         DEFB 00,0FCH,40H,20H,10H,20H,40H,0FCH
       102040FC
'0060  39381038   0020         DEFB 39H,38H,10H,38H,54H,54H,38H,10H
       54543810
'0068  39381092   0021         DEFB 39H,38H,10H,92H,92H,54H,38H,10H
       92543810
'0070  00000000   0022         DEFB 00,00,00,00,44H,82H,92H,6CH
       4482926C
'0078  00000078   0023         DEFB 00,00,00,78H,84H,84H,48H,0CCH
       848448CC
'0080  00000000   0024         DEFB 00,00,00,00,38H,44H,44H,38H
       38444438
'0088  00000000   0025         DEFB 00,00,00,00,10H,30H,10H,38H
       10301038
'0090  00000000   0026         DEFB 00,00,00,00,38H,44H,08H,7CH
       3844087C
'0098  00000000   0027         DEFB 00,00,00,00,78H,10H,48H,30H
       78104830
'00A0  00384444   0028         DEFB 00,38H,44H,44H,38H,00,00,00
       38000000
'00A8  00384408   0029         DEFB 00,38H,44H,08H,7CH,00,00,00
       7C000000
'00B0  0000107C   0030         DEFB 00,00,10H,7CH,10H,00,7CH,00
       10007C00
'00B8  00001000   0031         DEFB 00,00,10H,00,0FEH,00,10H,00
       FE001000
'00C0  00006092   0032         DEFB 00,00,60H,92H,0CH,60H,92H,0CH
       0C60920C
'00C8  001C1010   0033         DEFB 00,1CH,10H,10H,10H,50H,30H,10H
```

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ADDR  CODE      STMT SOURCE STATEMENT

      10503010
'00D0 00081410  0034          DEFB 00,08H,14H,10H,10H,10H,50H,20H
      10105020
'00D8 11001010  0035          DEFB 11H,00,10H,10H,10H,10H,10H,10H
      10101010
'00E0 00000820  0036          DEFB 00,00,08H,20H,0FEH,20H,08H,00
      FE200800
'00E8 00002008  0037          DEFB 00,00,20H,08H,0FEH,08H,20H,00
      FE082000
'00F0 00103854  0038          DEFB 00,10H,38H,54H,10H,10H,10H,10H
      10101010
'00F8 00101010  0039          DEFB 00,10H,10H,10H,10H,54H,38H,10H
      10543810
'0100 00000000  0040          DEFB 00,00,00,00,00,00,00,00
      00000000
'0108 00101010  0041          DEFB 00,10H,10H,10H,10H,10H,00H,10H
      10100010
'0110 00444444  0042          DEFB 00,44H,44H,44H,00H,00H,00H,00H
      00000000
'0118 0028FE28  0043          DEFB 00H,28H,0FEH,28H,0FEH,28H,00H,00H
      FE280000
'0120 00107E90  0044          DEFB 00H,10H,7EH,90H,7CH,12H,0FCH,10H
      7C12FC10
'0128 0042A448  0045          DEFB 00H,42H,0A4H,48H,10H,24H,4AH,84H
      10244A84
'0130 00609060  0046          DEFB 00H,60H,90H,60H,90H,8AH,84H,7AH
      908A847A
'0138 00101010  0047          DEFB 00H,10H,10H,10H,00H,00H,00H,00H
      00000000
'0140 00102040  0048          DEFB 00H,10H,20H,40H,40H,40H,20H,10H
      40402010
'0148 00100804  0049          DEFB 00H,10H,08H,04H,04H,04H,08H,10H
      04040810
'0150 004428FE  0050          DEFB 00H,44H,28H,0FEH,28H,44H,00H,00H
      28440000
'0158 00001010  0051          DEFB 00H,00H,10H,10H,7CH,10H,10H,00H
      7C101000
'0160 09110000  0052          DEFB 09H,11H,00H,00H,00H,00H,18H,18H
      00001818
'0168 00000000  0053          DEFB 00H,00H,00H,00H,7CH,00H,00H,00H
      7C000000
'0170 00000000  0054          DEFB 00H,00H,00H,00H,00H,00H,00H,18H
      00000018
'0178 00020408  0055          DEFB 00H,02H,04H,08H,10H,20H,40H,80H
      10204080
'0180 007C868A  0056          DEFB 00H,7CH,86H,8AH,92H,0A2H,0C2H,7CH
      92A2C27C
'0188 00103010  0057          DEFB 00H,10H,30H,10H,10H,10H,10H,38H
      10101038
'0190 007C8202  0058          DEFB 00H,7CH,82H,02H,3CH,40H,80H,0FEH
      3C4080FE
'0198 00FE0408  0059          DEFB 00H,0FEH,04H,08H,1CH,02H,82H,7CH
      1C02827C
'01A0 000C1424  0060          DEFB 00H,0CH,14H,24H,44H,0FEH,04H,04H
      44FE0404
'01A8 00FE80FC  0061          DEFB 00H,0FEH,80H,0FCH,02H,02H,84H,78H
      02028478
'01B0 00182040  0062          DEFB 00H,18H,20H,40H,0BCH,0C2H,82H,7CH
```

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 ADDR  CODE      STMT SOURCE STATEMENT

       BCC2827C
'01B8  00FE8202  0063         DEFB 00H,0FEH,82H,02H,04H,08H,10H,20H
       04081020
'01C0  007C8282  0064         DEFB 00H,7CH,82H,82H,7CH,82H,82H,7CH
       7C82827C
'01C8  007C8286  0065         DEFB 00H,7CH,82H,86H,7AH,04H,08H,30H
       7A040830
'01D0  00001818  0066         DEFB 00H,00H,18H,18H,00H,18H,18H,00H
       00181800
'01D8  09111818  0067         DEFB 09H,11H,18H,18H,00H,00H,18H,18H
       00001818
'01E0  00020820  0068         DEFB 00H,02H,08H,20H,80H,20H,08H,02H
       80200802
'01E8  00007C00  0069         DEFB 00H,00H,7CH,00H,7CH,00H,00H,00H
       7C000000
'01F0  00802008  0070         DEFB 00H,80H,20H,08H,02H,08H,20H,80H
       02082080
'01F8  117C8202  0071         DEFB 11H,7CH,82H,02H,06H,10H,10H,00H
       06101000
'0200  003C428A  0072         DEFB 00H,3CH,42H,8AH,96H,8CH,40H,3EH
       968C403E
'0208  00384482  0073         DEFB 00H,38H,44H,82H,82H,0FEH,82H,82H
       82FE8282
'0210  00F88484  0074         DEFB 00H,0F8H,84H,84H,0FCH,82H,82H,0FCH
       FC8282FC
'0218  003C4280  0075         DEFB 00H,3CH,42H,80H,80H,80H,42H,3CH,
       8080423C
'0220  00F88482  0076         DEFB 00H,0F8H,84H,82H,82H,82H,84H,0F8H
       828284F8
'0228  00FE8080  0077         DEFB 00H,0FEH,80H,80H,0F0H,80H,80H,0FEH
       F08080FE
'0230  00FE8080  0078         DEFB 00H,0FEH,80H,80H,0F0H,80H,80H,80H
       F0808080
'0238  003C4280  0079         DEFB 00H,3CH,42H,80H,80H,8EH,46H,3AH
       808E463A
'0240  00828282  0080         DEFB 00H,82H,82H,82H,0FEH,82H,82H,82H
       FE828282
'0248  00381010  0081         DEFB 00H,38H,10H,10H,10H,10H,10H,38H
       10101038
'0250  000E0404  0082         DEFB 00H,0EH,04H,04H,04H,04H,84H,78H
       04048478
'0258  00828488  0083         DEFB 00H,82H,84H,88H,0B0H,0C8H,84H,82H
       B0C88482
'0260  00808080  0084         DEFB 00H,80H,80H,80H,80H,80H,80H,0FEH
       808080FE
'0268  0082C6AA  0085         DEFB 00H,82H,0C6H,0AAH,92H,82H,82H,82H
       92828282
'0270  0082C2A2  0086         DEFB 00H,82H,0C2H,0A2H,92H,8AH,86H,82H
       928A8682
'0278  007C8282  0087         DEFB 00H,7CH,82H,82H,82H,82H,82H,7CH
       8282827C
'0280  00FC8282  0088         DEFB 00H,0FCH,82H,82H,0FCH,80H,80H,80H
       FC808080
'0288  007C8282  0089         DEFB 00H,7CH,82H,82H,82H,8AH,84H,7AH
       828A847A
'0290  00FC8282  0090         DEFB 00H,0FCH,82H,82H,0FCH,88H,84H,82H
       FC888482
'0298  007C8280  0091         DEFB 00H,7CH,82H,80H,7CH,02H,82H,7CH
```

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 ADDR   CODE      STMT SOURCE STATEMENT

        7C02827C
'02A0   00FE9210  0092          DEFB 00H,0FEH,92H,10H,10H,10H,10H,10H
        10101010
'02A8   00828282  0093          DEFB 00H,82H,82H,82H,82H,82H,86H,7AH
        8282867A
'02B0   00828282  0094          DEFB 00H,82H,82H,82H,82H,44H,28H,10H
        82442810
'02B8   00828282  0095          DEFB 00H,82H,82H,82H,92H,92H,92H,6CH
        9292926C
'02C0   00824428  0096          DEFB 00H,82H,44H,28H,10H,28H,44H,82H
        10284482
'02C8   00824428  0097          DEFB 00H,82H,44H,28H,10H,10H,10H,10H
        10101010
'02D0   00FE8408  0098          DEFB 00H,0FEH,84H,08H,10H,20H,42H,0FEH
        102042FE
'02D8   00382020  0099          DEFB 00H,38H,20H,20H,20H,20H,20H,38H
        20202038
'02E0   00804020  0100          DEFB 00H,80H,40H,20H,10H,08H,04H,02H
        10080402
'02E8   00380808  0101          DEFB 00H,38H,08H,08H,08H,08H,08H,38H
        08080838
'02F0   00102844  0102          DEFB 00H,10H,28H,44H,82H,00H,00H,00H
        82000000
'02F8   00000000  0103          DEFB 00H,00H,00H,00H,0FEH,00H,00H,00H
        FE000000
'0300   00201008  0104          DEFB 00H,20H,10H,08H,00H,00H,00H,00H
        00000000
'0308   00000078  0105          DEFB 00H,00H,00H,78H,04H,7CH,84H,7AH
        047C847A
'0310   008080B8  0106          DEFB 00H,80H,80H,0B8H,0C4H,84H,0C4H,0B8H
        C484C4B8
'0318   0000007C  0107          DEFB 00H,00H,00H,7CH,80H,80H,80H,7CH
        8080807C
'0320   00040474  0108          DEFB 00H,04H,04H,74H,8CH,84H,8CH,74H
        8C848C74
'0328   00000078  0109          DEFB 00H,00H,00H,78H,84H,0FCH,80H,7CH
        84FC807C
'0330   00182420  0110          DEFB 00H,18H,24H,20H,70H,20H,20H,20H
        70202020
'0338   05790074  0111          DEFB 05H,79H,00H,74H,8CH,84H,8CH,74H
        8C848C74
'0340   008080B8  0112          DEFB 00H,80H,80H,0B8H,0C4H,84H,84H,84H
        C4848484
'0348   00001000  0113          DEFB 00H,00H,10H,00H,10H,10H,10H,10H
        10101010
'0350   49310800  0114          DEFB 49H,31H,08H,00H,08H,08H,08H,08H
        08080808
'0358   00808084  0115          DEFB 00H,80H,80H,84H,88H,0B0H,0C8H,84H
        88B0C884
'0360   00101010  0116          DEFB 00H,10H,10H,10H,10H,10H,10H,10H
        10101010
'0368   000000EC  0117          DEFB 00H,00H,00H,0ECH,092H,92H,92H,92H
        92929292
'0370   000000B8  0118          DEFB 00H,00H,00H,0B8H,0C4H,84H,84H,84H
        C4848484
'0378   00000078  0119          DEFB 00H,00H,00H,78H,84H,84H,84H,78H
        84848478
'0380   818100B8  0120          DEFB 81H,81H,00H,0B8H,0C4H,84H,0C4H,0B8H
```

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 ADDR   CODE      STMT SOURCE STATEMENT

        C484C4B8
'0388   05070074  0121          DEFB 05H,07H,00H,74H,8CH,84H,8CH,74H
        8C848C74
'0390   000000B8  0122          DEFB 00H,00H,00H,0B8H,0C4H,80H,80H,80H
        C4808080
'0398   0000007C  0123          DEFB 00H,00H,00H,7CH,80H,78H,04H,0F8H
        807804F8
'03A0   0000107C  0124          DEFB 00H,00H,10H,7CH,10H,10H,10H,10H
        10101010
'03A8   00000084  0125          DEFB 00H,00H,00H,84H,84H,84H,8CH,74H
        84848C74
'03B0   00000082  0126          DEFB 00H,00H,00H,82H,82H,44H,28H,10H
        82442810
'03B8   00000082  0127          DEFB 00H,00H,00H,82H,82H,92H,92H,6CH
        8292926C
'03C0   00000084  0128          DEFB 00H,00H,00H,84H,48H,30H,48H,84H
        48304884
'03C8   05790084  0129          DEFB 05H,79H,00H,84H,84H,84H,8CH,74H
        84848C74
'03D0   000000FC  0130          DEFB 00H,00H,00H,0FCH,08H,30H,40H,0FCH
        083040FC
'03D8   00182020  0131          DEFB 00H,18H,20H,20H,40H,20H,20H,18H
        40202018
'03E0   00101000  0132          DEFB 00H,10H,10H,00H,00H,00H,10H,10H
        00001010
'03E8   00300808  0133          DEFB 00H,30H,08H,08H,04H,08H,08H,30H
        04080830
'03F0   00000022  0134          DEFB 00H,00H,00H,22H,54H,88H,00H,00H
        54880000
'03F8   00AA54AA  0135          DEFB 00H,0AAH,54H,0AAH,54H,0AAH,54H,0AAH
        54AA54AA
                  0136          END

ERRORS=0000
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