

COLOR/GRAPHICS ADAPTOR

User's Guide

DOC : CB005

COLOR/GRAPHICS ADAPTOR FOR 16-BIT PC

I. FEATURES

1. Attachable to the color monitor, television-frequency monitor, or home television sets (user-supplied RF modulator is required for home television sets).
2. Capable of operating in black-and-white or color mode. In the color mode, up to sixteen for foreground and eight background colors are available, in black-and-white mode, the character attributes of reverse video, blinking, and highlighting are available.
3. Two Operating Mode:
Alphanumeric Mode:
40 column x 25 rows for low-resolution monitor or home television.
80 column x 25 rows for high-resolution monitor.
Graphics Mode:
320 dots x 200 rows for high-resolution monitor.
640 dots x 200 rows for high-resolution black-and-white graphics mode.
4. Implementing a Motorola 6845 CRT controller, and contains 16K bytes of storage.
5. Three video interfaces:
A composite-video port, a direct drive port, and a connection interface for driving a usersupplied RF modulator.
6. A light pen interface is provided.

II. COLOR GRAPHICS ADAPTOR PROGRAMMING REFERENCE

This section provides information required for programming the color graphics adaptor.

It can be used in conjunction with the I/O port map for this board.

1. Initialization

Reset the video enable bit of the mode register (Port 3D8, Bit 3). Next, program the CRT controller chip (Ports 3D4 and 3D5) for the desired operation. Finally, program the mode and color registers (Ports 3D8 and 3D9).

2. Mode Register Programing

Video Mode	Mode Byte
40 x 25 Alpha B & W	2CH
40 x 25 Alpha Color	28H
80 x 25 Alpha B & W	2DH
80 x 25 Alpha Color	29H

320 x 200 Graphics B & W 0EH
 320 x 200 Graphics Color 0AH
 320 x 200 Graphics B & W 1EH

Note: To control high intensity of background using the blinking attributed in alpha modes, clear Bit 5 of the mode byte. Since Bit 3 of all mode bytes is set, the video will be enabled when the mode is programmed.

3. Color Register Programming

- Bit 0 — Selects blue as a border in 40 x 25 alpha mode or as a background color in 320 x 200 color graphics mode.
- Bit 1 — Selects green as a border color in 40 x 25 alpha mode or as a background color in 320 x 200 graphics mode.
- Bit 2 — Selects red as a border color in 40 x 25 alpha mode or as a background color in 320 x 200 color graphics mode.
- Bit 3 — Intensifies the border color in 40 x 25 alpha mode or background color in 320 x 200 color graphics mode.

The above bits define the following colors:

0000 = Black	0110 = Brown	1100 = Lt Red
0001 = Blue	0111 = Lt Gray	1101 = Lt Magenta
0010 = Green	1000 = Dk Gray	1110 = Yellow
0011 = Cyan	1001 = Lt Blue	1111 = White
0100 = Red	1010 = Lt Green	
0101 = Magenta	1011 = Lt Cyan	

- Bit 4 — Intensifies the background colors in the alpha mode.
- Bit 5 — Selects the palette for 320 x 200 color Graphics mode. The palette defines the color produced by each value of the pixel (C1, C0) for that point of the screen.

If Bit 5 = 1			If Bit 5 = 0		
C1	C0	Color	C1	C0	Color
0	0	Background Color	0	0	Background color
0	1	Cyan	0	1	Green
1	0	Magenta	1	0	Red
1	1	White	1	1	Brown

4. Status Register Interpretation

The status register (Port 3DA) of the color graphics video board is used for video buffer access timing and light pen testing.

- Bit 0 — This bit is high when the video display is blanked during a sync interval. In 80 x 25 alpha mode, the video buffer should not be accessed by the CPU unless this bit is high or the access will produce interference in the form of a short horizontal line on the display.

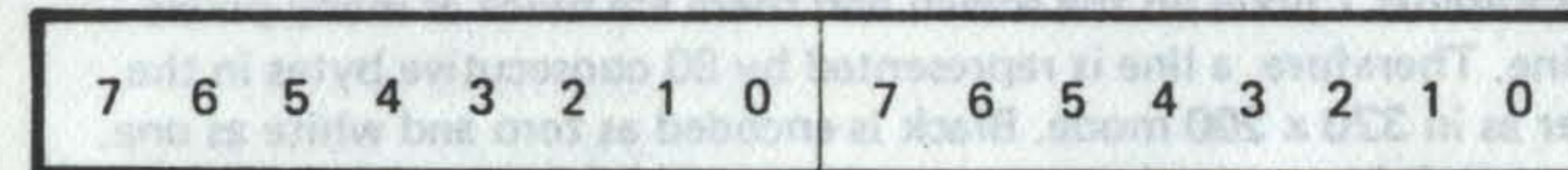
- Bit 1 — Indicates that a rising edge from the light pen switch has set the light pen trigger. This status may be cleared or set by out-putting any data byte to ports 3DB or 3BC respectively.
- Bit 2 — If 0, indicates the light pen switch is on. Switch is not debounced or latched.
- Bit 3 — This signal is high during the vertical sync interval of the display.

5. Video Buffer Organization

The video buffer consists of 16K bytes of RAM located at B8000-BBFFF. The format of data in the memory is different from each type of display mode.

80 x 25 Alpha Modes

Display-character code Byte Attribute Byte



Each character position is defined by two consecutive bytes in the video buffer. The first byte is the ASCII character code, and the second byte is the attribute. The screen holds 2000 characters which requires 4,000 bytes. Consecutive locations in the buffer located at the upper left corner of the screen. The 256 character patterns are generated by a 2K byte ROM on the Color/Graphics Adaptor. It defines the character as a 7 x 7 pattern in an 8 x 8 box. The attribute byte is defined as follows:

- Bit 0 — Blue Character
 - Bit 1 — Green Character
 - Bit 2 — Red Character
 - Bit 3 — Intensify Character
 - Bit 4 — Blue Background
 - Bit 5 — Green Background
 - Bit 6 — Red Background
 - Bit 7 — Blinking Character
- Bit 7 Can be redefined to intensify background by setting Bit 5 of the mode register.

For black and white modes, select black by turning all colors off and white by turning all colors on.

40 x 25 Alpha Modes

These modes are similar to the 80 x 25 alpha modes except that the screen only holds 1,000 characters and therefore required 2,000 bytes.

320 x 200 Graphics

This mode uses 16,000 bytes of memory, organized a 4 pixels horizontally per byte. The screen is divided into two buffers, the first holding data for the even scan lines (0, 2, 4 . . . 198) at addresses B8000-B9F3F and the second holding data for the odd scan lines (1, 3, 5, . . . 199) at addresses BA000-BBF3F. Each pixel is defined by 2 bits, with the top left corner of the screen being B7 and B6 of the first byte. Each line consists of 320 pixels, which is defined by 80 consecutive bytes in the buffer. The color of the displayed pixel is selected from the current palette by the value of the bits (C1, C0, where C1 is the higher order bit). See the description of Bit 5 in the color register programming for a definition of the palettes. The black and white mode is similar to color, except that the color burst is disabled.

640 x 200 Black and White Graphics

This mode is similar to 320 x 200 color graphics mode except that each bit represents 1 pixel on the screen and there are twice as many pixels per line. Therefore, a line is represented by 80 consecutive bytes in the buffer as in 320 x 200 mode. Black is encoded as zero and white as one. The upper left corner of the screen is B7 of the first byte of the buffer.

6. Character Generation in Graphics Modes

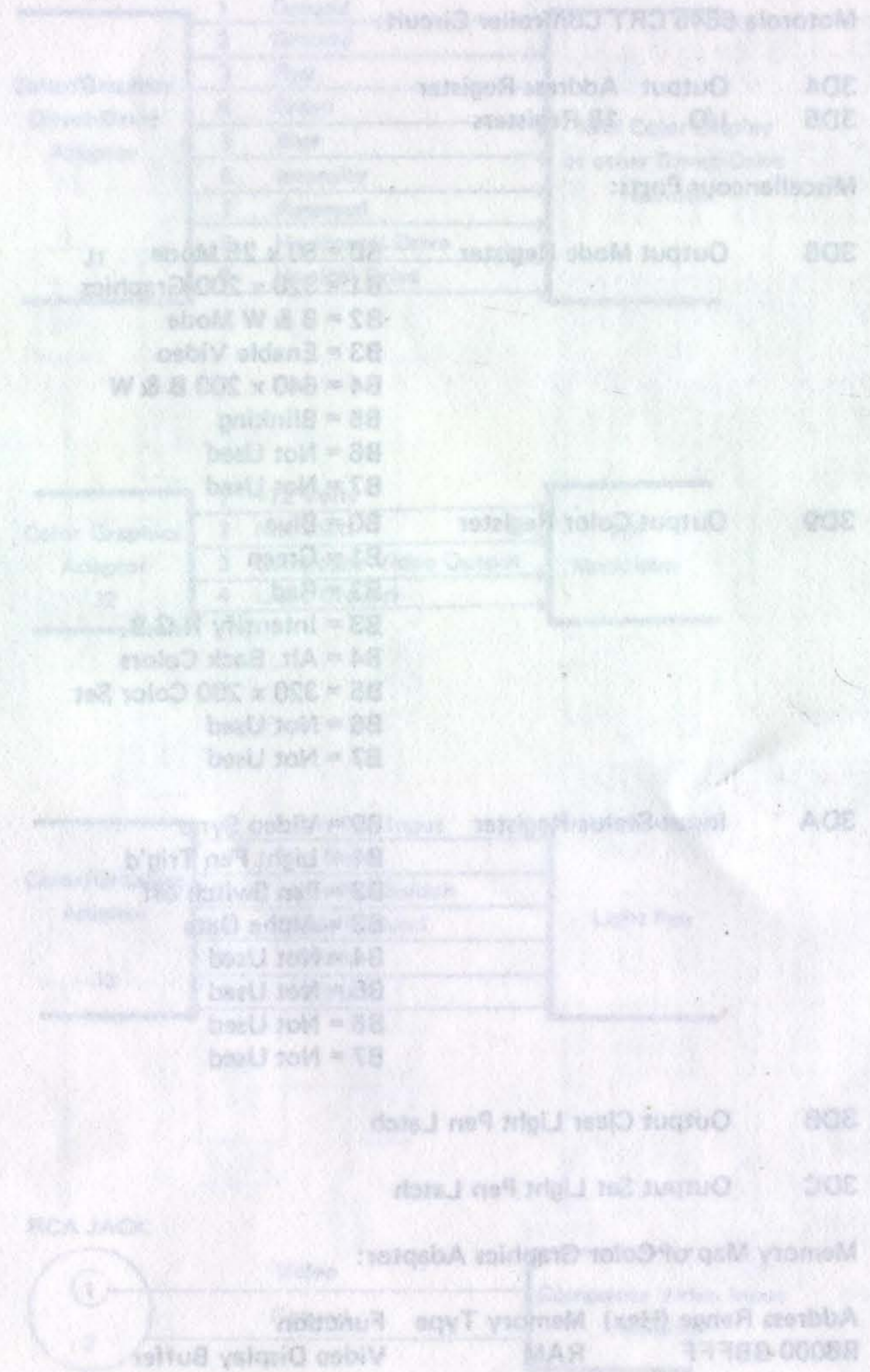
A table of the first 128 characters similar to the alpha mode character generator is in the ROM. Each character is defined by 8 consecutive bytes, representing the LIT pixels for each row of the character from top to bottom. The most significant bit represents the left-hand dot of a row. When the data is transferred to the video memory to be displayed, it must be split into even and odd row data and written to the appropriate buffers, any other characters which are to be displayed (including those corresponding to Codes 128-255 in alpha mode) must be defined by the user. These patterns will be accessed as codes 128-255 by the ROM's INT 10H graphics character routines if the user points to the table with interrupt vector 1FH.

7. Standard Initialization for 6845 CRT Controller Circuit

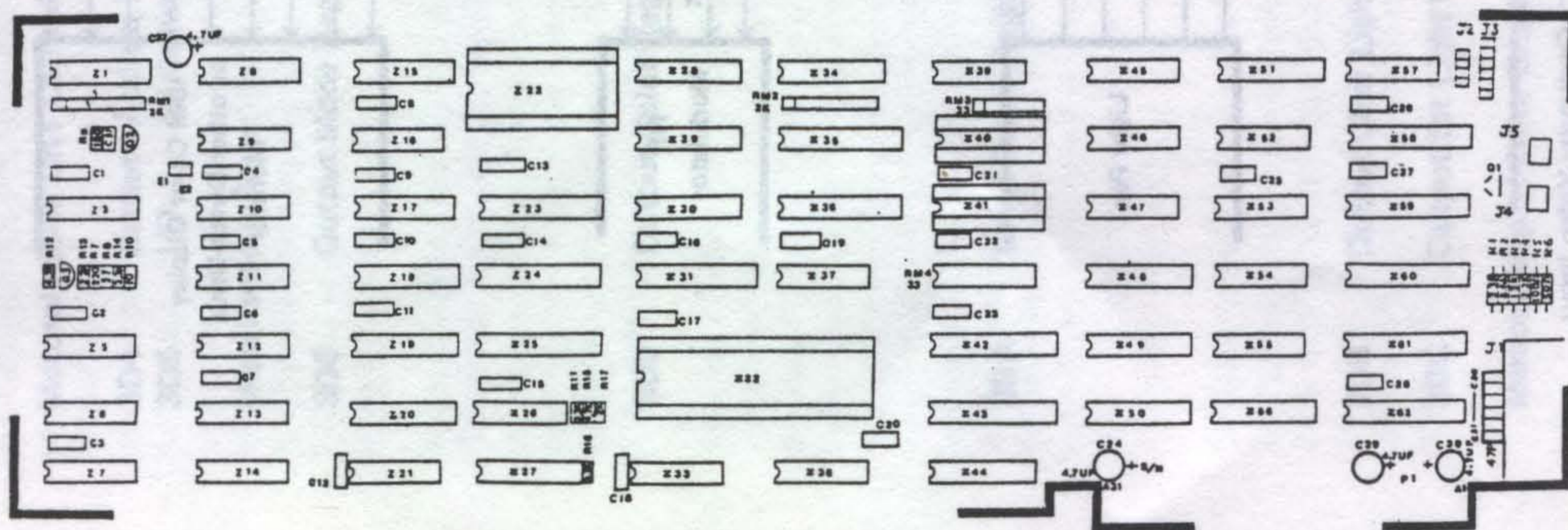
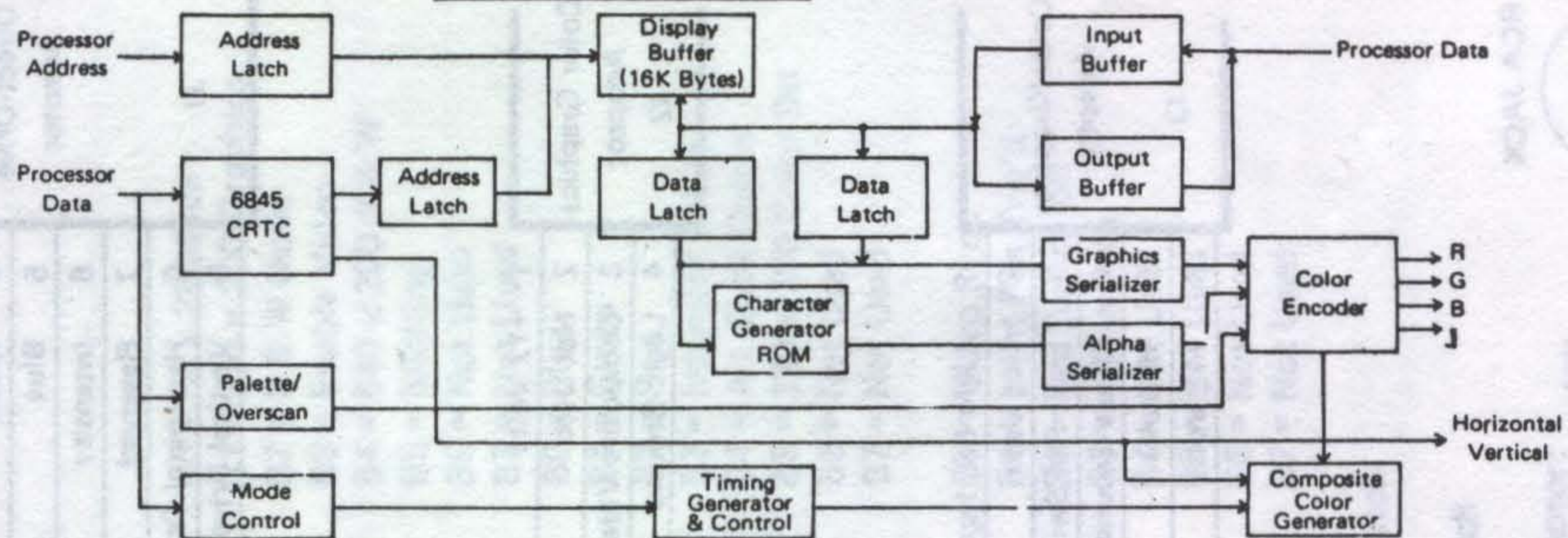
The CRT controller is initialized for a given display mode by outputting a string of 16 bytes to its register 0 - 15 respectively. For each byte to be output, the register number must first be output to the address register (port 3D4), followed by the data byte to the desired register (port 3D5).

NO MAP, COLOR GRAPHICS ADAPTOR

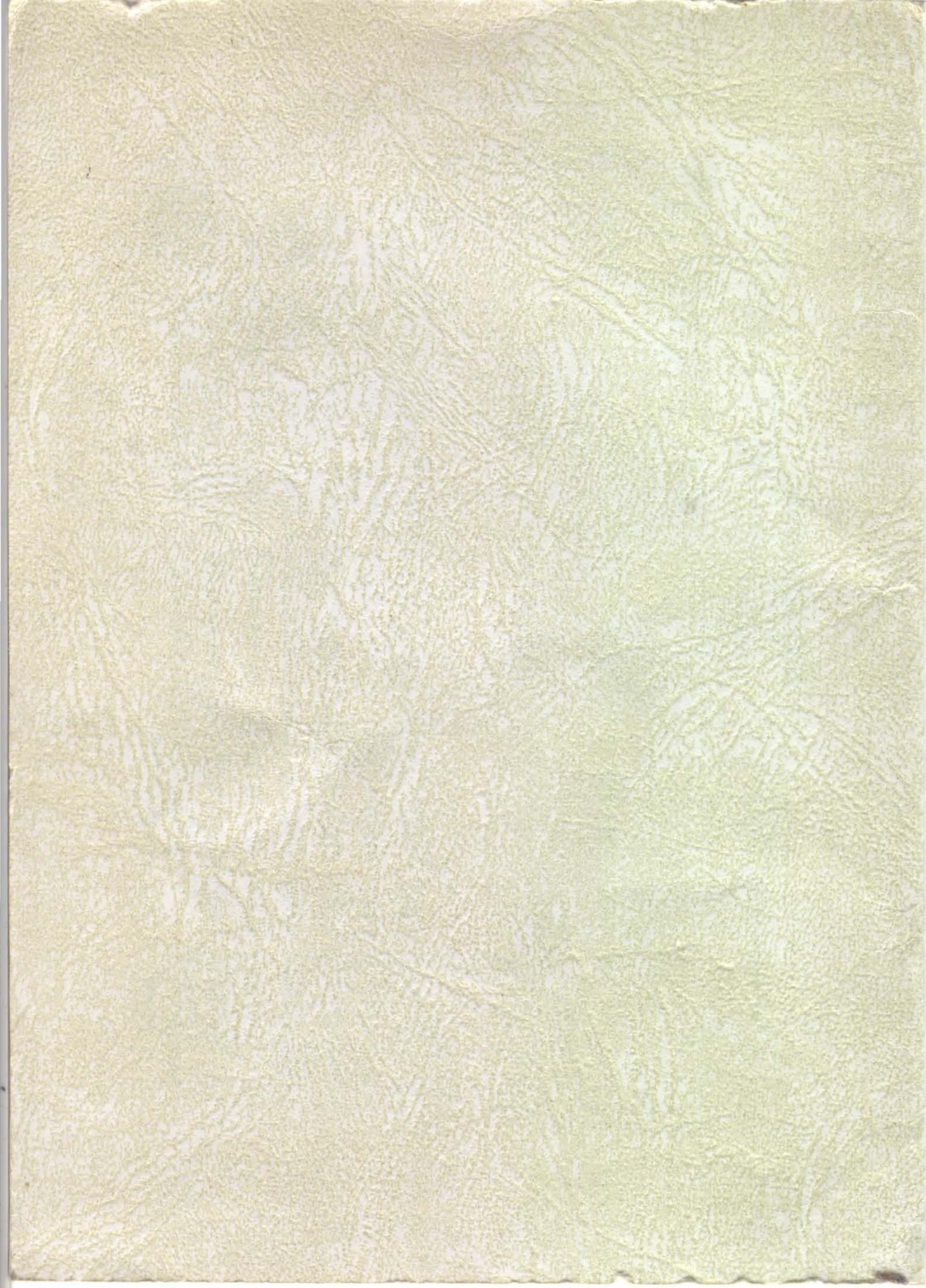
The strings used by the ROM for the 40 x 25 alpha, 80 x 25 alpha and graphics modes are given in the description of INT 10H.



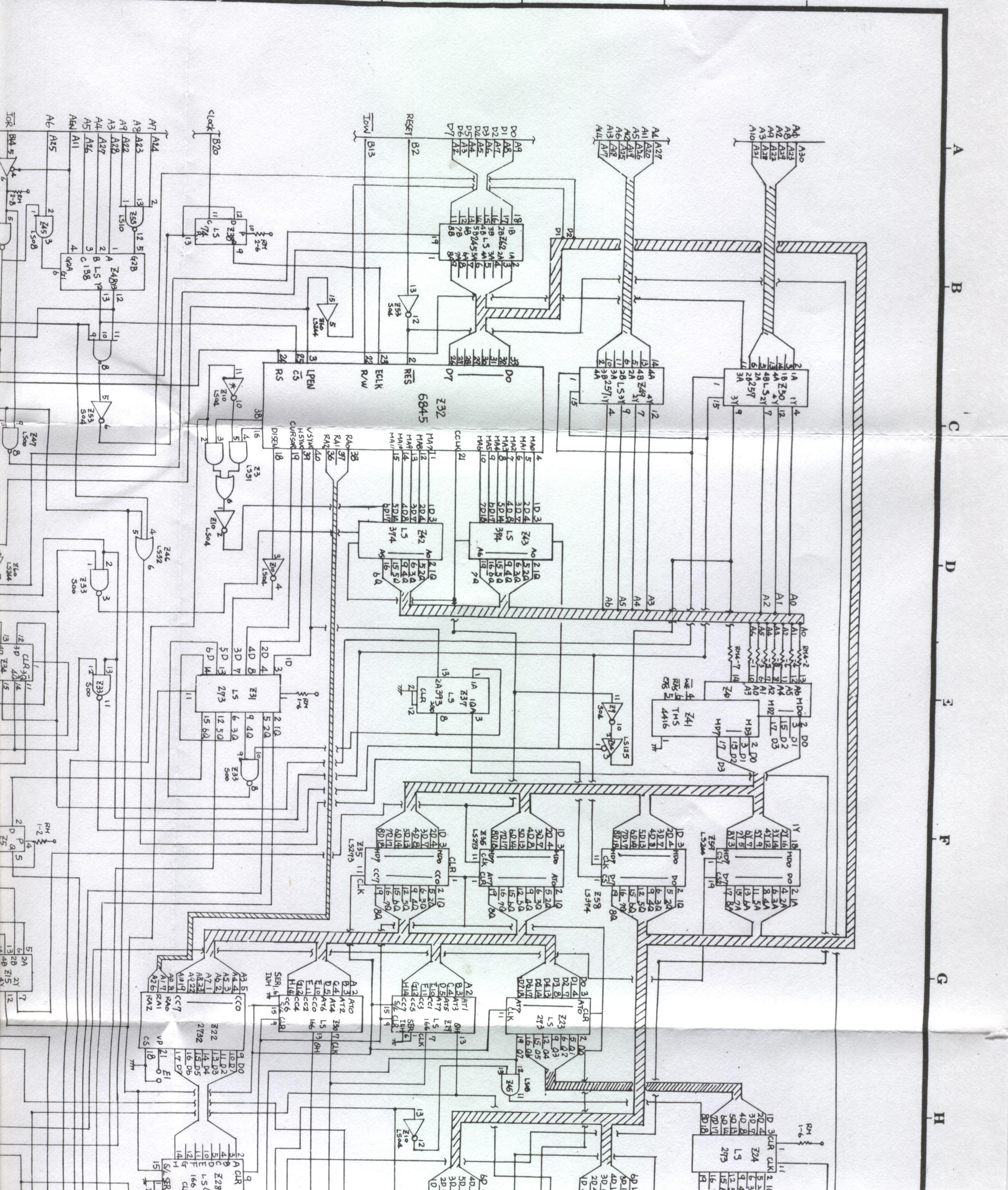
Functional Block Diagram



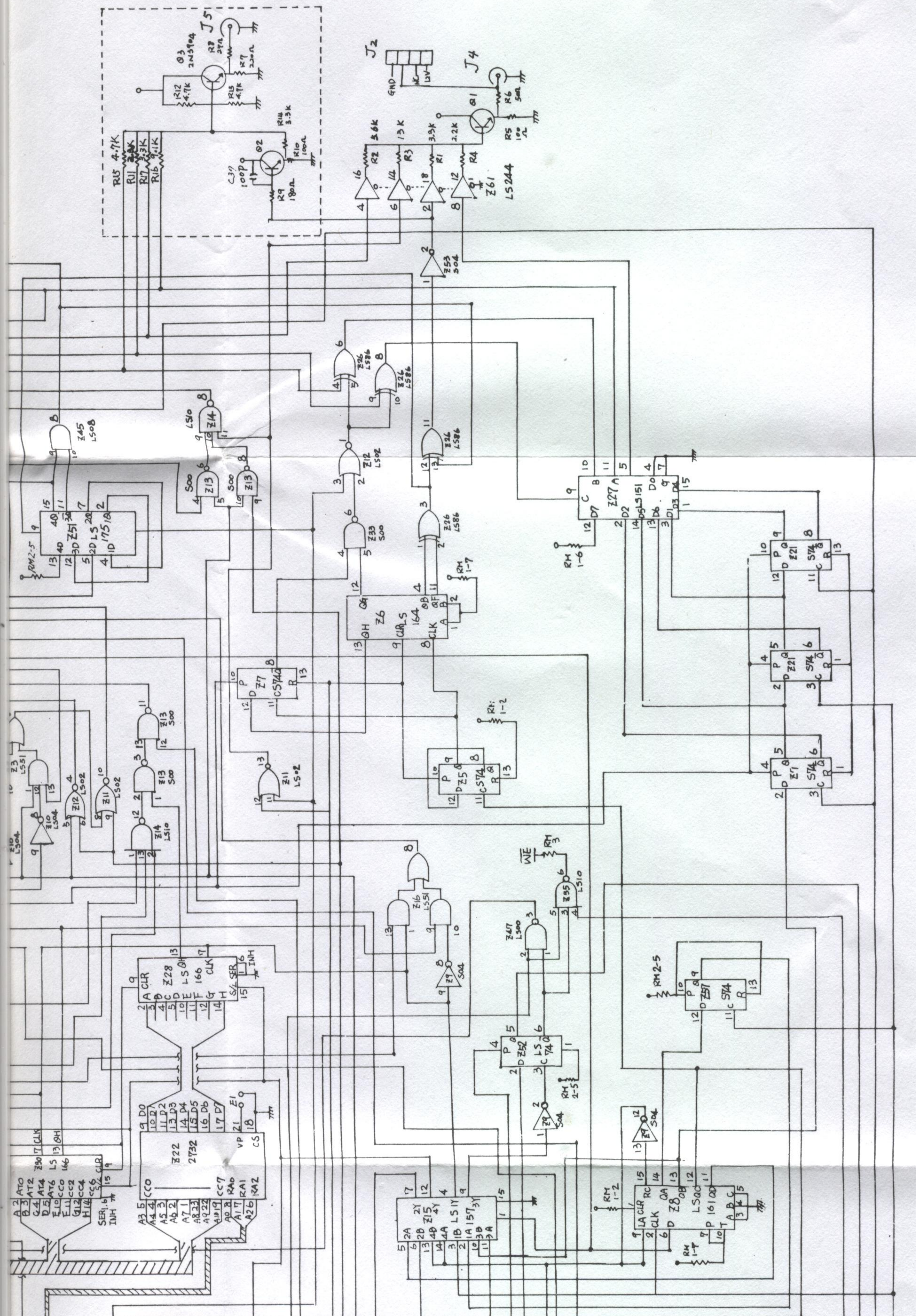
10 MAP. COLOR GRAPHICS ADAPTOR



1
2
3
4
5
6



A
B
C
D
E
F
G
H



DRAWING NO. SHEET NO. JOB NO.

DESIGNED BY

APPROVED BY

SCALE DATE

COLOR GRAPHIC

