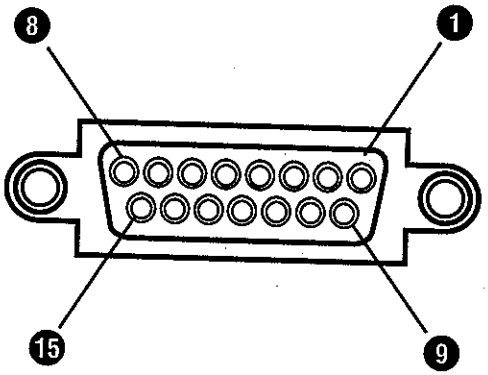
APPENDIX A:

CM2125 Connector Chart	
Connector	**Computer Monitor Type**
1	CGA, MDA, Hercules
2	EGA
3	PGC
4A	VGA, PS/2, SVGA, XGA
6	BNC Input
7	13 W3
8 & 8F*	Apple® or Macintosh®
Universal	Adapts to match any computer monitor type

* Monitor with male input connection

APPENDIX B:

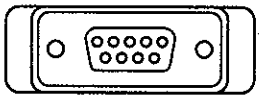
CM2125 Sync & Video Output Pin Configuration



PIN #	OUTPUT	
1	RED	RED
2	GREEN	GREEN
3	BLUE	BLUE
4	INTENSITY	
5	INTENSITY	
6	H SYNC	GRAY
7	COMP SYNC	WHITE
8	GND	BLK
9	RED GND	BLK
10	GREEN GND	BLK
11	BLUE GND	BLK
12	INTENSITY	
13	GND	BLK
14	V SYNC	VIOLET
15	+5 MODE	

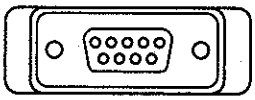
APPENDIX C:

Connector Pin Configurations



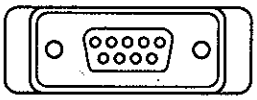
CONNECTOR #1 — **CGA MDA. HERCULES**

PIN #	SIGNAL
1	GND
2	GND
3	RED
4	GREEN
5	BLUE
6	INTENSITY
7	GREEN
8	H SYNC
9	SYNC



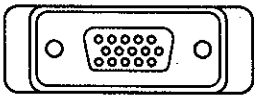
CONNECTOR #2 — **EGA**

PIN #	SIGNAL
1	GND
2	INTENSITY
3	RED
4	GREEN
5	BLUE
6	INTENSITY
7	INTENSITY
8	H SYNC
9	V SYNC



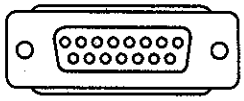
CONNECTOR #3 — **PGC**

PIN #	SIGNAL
1	RED
2	GREEN
3	BLUE
4	COMP SYNC
5	NC
6	RED GND
7	GREEN GND
8	BLUE GND
9	NC



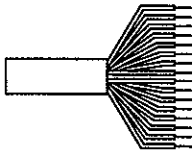
CONNECTOR #4 — **VGA,SVGA PS/2, XGA**

PIN #	SIGNAL
1	RED
2	GREEN
3	BLUE
4	NC
5	GND
6	RED GND
7	GREEN GND
8	BLUE GND
9	NC
10	GND
11	NC
12	NC
13	H SYNC
14	SYNC
15	NC



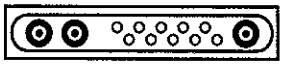
CONNECTOR #8 & 8F — **APPLE, MAC**

PIN #	SIGNAL
1	RED GND
2	RED
3	COMP SYNC
4	NC
5	GREEN
6	GREEN GND
7	NC
8	NC
9	BLUE
10	NC
11	GND
12	V SYNC
13	BLUE GND
14	GND
15	H SYNC



UNIVERSAL

SIGNAL	COLOR
RED	BROWN
GREEN	RED
BLUE	ORANGE
INTENSITY	PINK
INTENSITY	YELLOW
H SYNC	GREEN
COMP SYNC	LIGHT GREEN
GND	BLUE
RED GND	PURPLE
GREEN GND	SLATE
BLUE GND	WHITE
INTENSITY	BLACK
GND	BROWN/WHITE
V SYNC	RED/WHITE
+5 MODE	BLACK/WHITE



CONNECTOR #7 – 13W3

PIN #	SIGNAL
A1	RED
A2	GREEN
A3	BLUE
1	GND
2	V SYNC
3	NC
4	GND
5	C SYNC
6	H SYNC
7	GND
8	NC
9	NC
10	CASE GND

APPENDIX D:

Computer Monitor Formats

Monitor Type	H FREQ	V FREQ	H PIXEL	V PIXEL	DIGITAL ANALOG	H SYNC	V SYNC	Sync Adder	Interlace
CGA	15.7	60.0	640	200	DIGITAL	+	+	OFF	OFF
NEC DH	16.0	60.3	640	200	DIGITAL	+	-	OFF	OFF
HITACHI 2	17.3	62.4	512	512	ANALOG	+	-	OFF	ON
HERCULES	18.4	50.0	720	350	DIGITAL	+	-	OFF	OFF
MDA	18.4	50.0	720	350	DIGITAL	+	-	OFF	OFF
EGA	21.8	60.0	640	350	DIGITAL	+	-	OFF	OFF
NEC P2	24.8	56.4	640	400	DIGITAL	-	-	OFF	OFF
PGC	30.5	60.0	640	400	ANALOG	COMPOSITE SYNC		OFF	OFF
PGC	30.5	60.0	640	480	ANALOG	COMPOSITE SYNC		OFF	OFF
NEC P1	31.5	59.4	720	480	ANALOG	-	-	OFF	OFF
MCGA	31.5	60.0	640	480	ANALOG	-	-	OFF	OFF
VGA 3	31.5	60.0	640	480	ANALOG	-	-	OFF	OFF
NEC 3D+	31.5	60.1	640	480	ANALOG	+	+	OFF	OFF
MCGA	31.5	70.1	720	400	ANALOG	-	+	OFF	OFF
VGA 1	31.5	70.1	640	350	ANALOG	+	-	OFF	OFF
VGA 2	31.5	70.1	720	400	ANALOG	-	+	OFF	OFF
SUPER VGA	35.2	56.0	800	600	ANALOG	+	+	OFF	OFF
8514A	35.2	87.0	1024	768	ANALOG	+	+	OFF	ON
XGA	35.2	87.0	1024	768	ANALOG	+	+	OFF	ON
MAC II	35.5	67.0	640	480	ANALOG	-	-	GREEN	OFF
HITACHI 1	48.4	60.0	1387	768	ANALOG	-	-	GREEN	OFF
SUPER MAC	48.8	60.0	1024	768	ANALOG	-	-	GREEN	OFF
8508 2	70.7	82.2	736	828	ANALOG	-	+	OFF	OFF
8508 1	70.7	93.5	736	736	ANALOG	+	-	OFF	OFF

APPENDIX E:

CM2125
Computer Monitor Setup Storage Locations

RECALL	FORMAT	HORIZ FREQ. (kHz)	VERT. FREQ. (Hz)	HORIZ. PIX	VERT. PIX	Connector
0	CGA, EGA LO 640x200/60Hz	15.8	60.5	640	200	1
1	MDA, HERCULES 720x350/50Hz	18.4	50.0	720	350	1
2	EGA, HI 640x350/60Hz	21.8	60.0	640	350	2
3	PGC 1 640x400/60Hz	30.5	60.0	640	400	3
4	PGC 2 640x480/60Hz	30.5	60.0	640	480	3
5	VGA 1 640x350/70Hz	31.5	70.1	640	350	4
6	VGA 2, MCGA 1 720x400/70Hz	31.5	70.1	720	400	4
7	VGA 3, MCGA 2 640x480/60Hz	31.5	60.0	640	480	4
8	SVGA 800x600/56Hz	35.2	56.0	800	600	4
9	8514A, XGA 1024x768/87Hz	35.5	87.0	1024	768	4
10	MAC 640x480/67Hz	35.0	67.0	640	480	5
11	Generic 1024x768/60Hz	48.4	60.5	1024	768	4
12	Apollo 1280x1024/60Hz	64.0	60.0	1280	1024	6
13	DEC 1024x768/60Hz	54.9	60.0	1024	874	6
14	SUN 1152x900/66Hz	61.8	66.0	1152	900	6
15	IBM, Apollo 1280x1024/60Hz	63.4	60.0	1280	1024	6
16	Apollo 1024x800/76Hz	64.0	76.0	1024	800	6
17	IBM 1360x1024/67Hz	70.8	67.0	1360	1024	6
18	Apollo 1280x1024/70Hz	75.1	70.0	1280	1024	6
19	Radius 1152x882/72Hz	66.0	72.0	1152	882	6
20	Radius/MAC port. 640x870/75Hz	68.9	75.0	640	870	6
21	Radius/MAC 1152x870/75Hz	68.7	75.0	1152	870	-
22	Radius 1152x870/72Hz	64.8	72.0	1152	870	-
23	Apollo 1280x1024/64Hz	68.2	64.0	1280	1024	-

Continued on next page

CM2125
Computer Monitor Setup Storage Locations

RECALL	FORMAT	HORIZ FREQ. (kHz)	VERT. FREQ. (Hz)	HORIZ. PIX	VERT. PIX	Connector
24	SUN 1600x1280/67Hz	89.2	66.9	1600	1280	-
25	MAC 832x624/75Hz	49.7	74.6	832	624	-
26	SuperMac 1024x768/75Hz	60.2	75.0	1024	768	-
27	NTSC Mono Video Monitor	15.8	60.0	640	242	-
28	VESA 640x480/72Hz	37.9	72.0	640	480	-
29	VESA 800x600/60Hz	37.9	60.0	800	600	-
30	VESA 800x600/72Hz	48.1	72.0	800	600	-
31	VESA 1024x768/60Hz	48.4	60.0	1024	768	-
32	VESA 1024x768/70Hz	56.5	70.0	1024	768	-
33	XGA-2 720x350/88Hz	39.4	87.9	720	350	-
34	XGA-2 720x400/88Hz	39.4	87.9	720	400	-
35	XGA-2 640x480/75Hz	39.4	75.0	640	480	-
36	XGA-2 1024x768/75Hz	61.1	75.0	1024	768	-
37	Sony 1024x768/60Hz	48.8	60.0	1024	768	-
38	Sony 1152x900/66Hz	61.8	66.0	1152	900	-
39	Sony 1280x1024/60Hz	63.3	60.0	1280	1024	-
40	Samsung 1006x1048/60Hz	62.8	59.8	1006	1048	-
41	DEC 1024x864/60Hz	54.0	60.0	1024	864	-
42	DEC 1280x1024/60Hz	70.7	66.5	1280	1024	-
43-69	User Definable					
99	15 Second Pattern Sequence					

APPENDIX F:

VIDEO OUTPUT COLOR COMBINATIONS

DIGITAL MONITORS

COLOR	R	G	B	I
Black	0	0	0	0
Blue	0	0	1	0
Green	0	1	0	0
Cyan	0	1	1	0
Red	1	0	0	0
Magenta	1	0	1	0
Brown	1	1	0	0
White	1	1	1	0
Dark Gray	0	0	0	1
Light Blue	0	0	1	1
Light Green	0	1	0	1
Light Cyan	0	1	1	1
Light Red	1	0	0	1
Lt. Magenta	1	0	1	1
Yellow	1	1	0	1
Intense White	1	1	1	1

ANALOG MONITORS

COLOR	R	G	B
Black	0	0	0
Blue	0	0	1
Green	0	1	0
Cyan	0	1	1
Red	1	0	0
Magenta	1	0	1
Brown	1	1	0
White	1	1	1

APPENDIX G:

Calculating A Monitor's Bandwidth

A monitor's bandwidth is determined by its ability to display a sharp, crisp picture. The higher the bandwidth, the more resolution and clarity appears in the picture. A monitor's bandwidth is best checked with a pattern that produces lines that are a single pixel wide (a pixel is the smallest picture element possible).

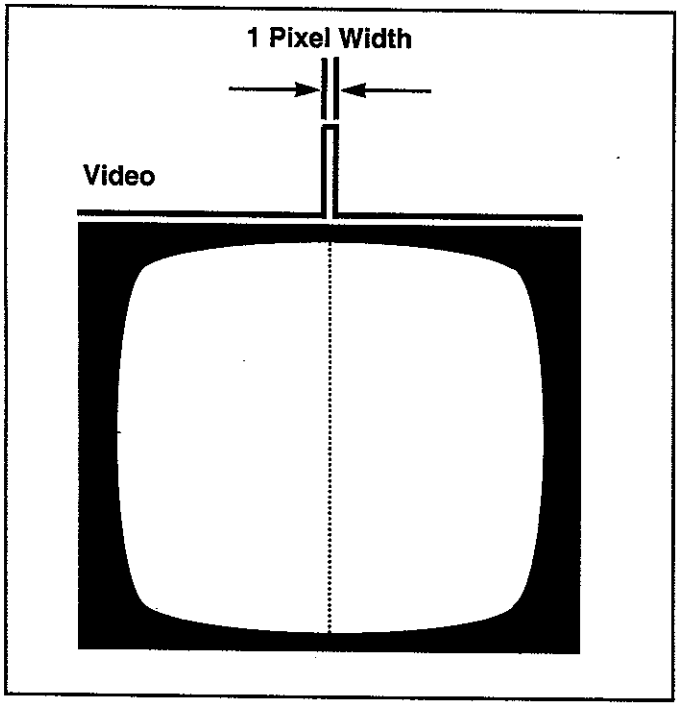


Fig. 65 - A one pixel wide line is best suited for testing a monitor's maximum bandwidth. A crisp, distinct line shows that the monitor has the bandwidth needed to "turn on" a single pixel at a time.

For an example let's calculate the required bandwidth of a VGA monitor. The VGA standard has 640 horizontal pixels and the horizontal scanning frequency is 31.5 kHz.

Inverting the horizontal scanning frequency gives a total horizontal scan time of 31.7 micro-seconds. About 80% of this time is active video (what's seen on the monitor) and about 20% is blanking. So 25.4 micro-seconds is active video and 6.3 micro-seconds is blanking.

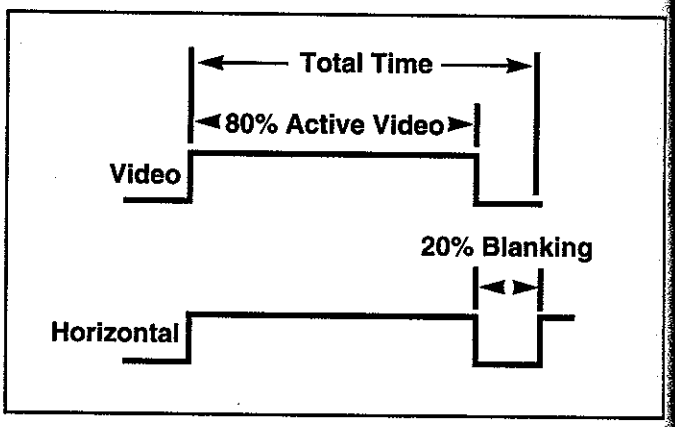


Fig. 66 - One scan line is made up of active video and blanking.

If 640 pixels must be fit into the 25.4 micro-second active display time, we can find the amount of time it takes to turn on one pixel by dividing 25.4 micro-seconds by 640 pixels. This shows that each pixel is on for 39.7 nano-seconds (39.7 X 10^{-9} seconds). If we invert 39.7 nano-seconds we get a frequency of 25.2 MHz. So in order to see a crisp, distinct line of one pixel width, the bandwidth of the video amplifiers in a VGA monitor must be 25.2 MHz or greater.

Horizontal Scan = 31.5 kHz

Total Scan Time = 1/31.5 kHz = 31.7 usec.

Active Video Time = (80%) (31.7 usec.) = 25.4 usec.
Note: 640 Pixels will be displayed in 25.4 usec.

Display time per pixel = 25.4 usec./640 pixels = 39.7 nanosec.

Bandwidth required to turn on a single pixel = 1/39.7 x 10^{-9} = 25.2 MHz

Fig. 67 - Bandwidth calculation for a VGA monitor.

APPENDIX H:

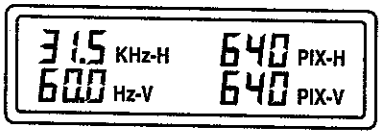
Pixel Parameter Errors

The CM2125 cannot accept the sync and pixel parameter conditions when the vertical pixel value exceeds the time allotted by the horizontal and vertical scan frequency.

When this occurs, the pixel enunciator blinks and the CM2125 automatically determines and displays the maximum allowable pixel value. You can press "ENTER" to accept this value or you can enter a value lower than the one displayed.

Here's the explanation for this condition:

For example you've programmed these parameters into the CM2125:



The PIX-V enunciator blinks and the vertical pixel value is 521. Here's why:

The total scan time for one full field (raster) is 16.7 mSec

1/ V SYNC = scan time of one field
1/60.0 Hz = 16.667 mSec

The total scan time for one line is 31.7 uSec

1/ H SYNC = scan time of one line
1/31.5 KHz = 31.746 uSec

If we divide the scan time for one field by the scan time for one line we will get the maximum number of lines that can be displayed.

$$\frac{\text{Scan time of one field}}{\text{Scan time of one line}} = \text{maximum number of lines that can be displayed}$$

$$\frac{16.667 \text{ mSec}}{31.746 \text{ uSec}} = 525 \text{ lines}$$

The CM2125 will display 521 PIX-V because four lines are used for vertical sync.

APPENDIX I:

Pixels, Scan Frequency And Dot Clock Frequency

Horizontal scan frequency and horizontal pixels are two parameters that work together to establish a computer monitor's dot clock frequency. Dividing the number of displayed horizontal pixels by the horizontal active video time tells you how fast the CM2125 clocks pixels out to the computer monitor.

$$\text{Dot Clock Frequency} = \frac{\text{Horizontal Pixels}}{\text{Horizontal Active Video Time}}$$

For example a computer monitor with a scanning frequency of 48 KHz (active video time of 18.75 micro-seconds) and a horizontal pixels resolution of 1280 has a dot clock frequency of:

$$\text{Dot Clock Frequency} = \frac{1280}{18.75\ \mu\text{Sec}} = 68.3\ \text{MHz}$$

The CM2125 clocks pixels to this computer monitor at a 68 MHz rate.

Here's how pixels, scan frequency and dot clock frequency interact:

Waveform B (Fig. 68) has a faster scan frequency than waveform A. Because of this, waveform B has less active video display time.

If we keep the number of pixels constant from waveform A to B, the pixels must be clocked out faster to waveform B than waveform A (fitting the same number of pixels in less time). Hence, an increased dot clock frequency.

The CM2125 has a maximum dot clock frequency of 125 MHz. It provides a maximum horizontal and vertical pixel resolution of 2048. The CM2125 can provide up to 2048 horizontal pixels provided the monitor's horizontal scan frequency and the number of pixels don't exceed the CM2125's dot clock frequency.

The CM2125 tests all computer monitors regardless of their horizontal scan frequency and number of pixels. Even on monitors with extremely high dot clock frequencies (e.g. 300 MHz), the CM2125 provides full, centered, locked-in patterns for troubleshooting and alignment.

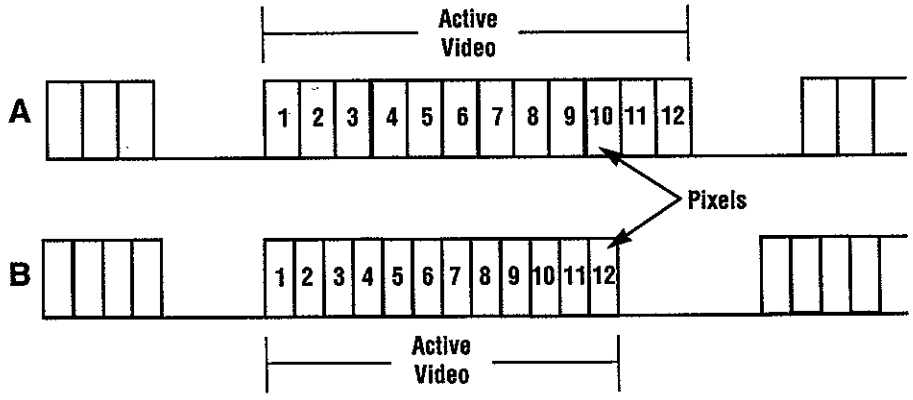


Fig. 68 - B Pixels = A Pixels B Hfreq > A HFreq B Dot Clock > A Dot Clock