



Product Specification -

LC12 High-Bright Monitor

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1.0 Introduction

This document defines the electromechanical parameters and operating characteristics for a 12" Active Matrix Liquid Crystal Display (AMLCD) based product, hereafter referred to as the Monitor. It is intended for operation in high ambient light, outdoor environment. The Monitor has a scaleable video format capable of displaying a minimum of VGA (640 x 480) through XGA (1024 x 768) input resolution.

The Monitor can be driven directly from the standard analog Video Graphics Array (VGA) output on a personal computer (PC). It consists of a 12.1" viewable diagonal LCD Panel with optical elements, Cold-Cathode Fluorescent Backlight, Backlight Inverter Board, and LCD Controller Board. Cooling fans provide temperature stabilization within the Monitor's operating environment. Two (2) chassis mounted connectors at the rear provide for video signal and DC power input connections. These components will be mounted in a fully enclosed chassis.

1.1 Display Format

The Monitor is compatible with IBM VGA¹ and VESA² video standards. Its operating frequency range is 31.5 KHz to 65.5 KHz horizontal; 60 Hz to 72 Hz (non-interlaced) vertical. Specific video resolutions supported are as follows:

Video Resolution	Number of Bits/Color	Number of Colors
640 x 400	6	262,144
640 x 480	6	262,144
720 x 400	6	262,144
800 x 600	6	262,144
1024 x 768	6	262,144

For IBM VGA¹ modes, the Monitor will accept 640 pixels horizontally; 400 or 480 lines vertically and 800 pixels or 1024 pixels horizontally, 600 lines or 768 lines vertically for the VESA² modes. Figure 9 defines the video signal timing requirements.

The LCD Controller Board will automatically program itself, sensing incoming horizontal/vertical frequencies and sync pulse polarities to completely "fill" the active display area of the Monitor with the video resolution being presented. Section 4.4.1 (Video Mode Definitions) defines parameters for video resolution detection by the LCD Controller Board.

Note: IBM VGA¹ modes with border and the 720 x 400 video resolution are excluded from completely filling the active display area horizontally. Only the first 640 pixels will be displayed.

¹ IBM VGA is a registered trademark of International Business Machines Corporation

² VESA is a registered trademark of Video Electronics Standards Association.

2.0 Basic Construction

2.1 Weight

Monitor weight does not exceed 5 Kgs (11 lbs).

2.2 Mechanical Mounting Requirements

Per Planar Mechanical Outline drawing 074-0666-01

2.3 Monitor Electronics

Electronic components requiring heat sinks are installed independent of the Monitor enclosure. That is, its sheet metal chassis is not used as a heat sink for any electronic component.

2.4 Cooling Fan

Cooling fans are installed to maintain appropriate internal operating temperatures when the Monitor is subjected to its operating environment of Section 3. Forced air convection is used to cool the LCD Panel (front and back).

2.5 Vandal Glass

The Monitor is designed to operate with a vandal glass 289 mm x212 mm x 10 mm in place. This vandal glass is not provided with the Monitor.

2.6 Air Filtration

An air filter mesh is included to prevent ingress of insects and ensure continual flow of cooling air within the Monitor. The air filter mesh is externally accessible for cleaning.

2.7 Connectors

There are two (2) connectors supplied as an integral part of the Monitor.

2.7.1 Video Signal Connector

The Monitor unit includes a chassis mounted 15-pin female mini D-Shell connector (AMP 748390-5 or equivalent) with socket contacts at the rear of the Monitor. It is shielded for electromagnetic interference (EMI) purposes. Refer to Section 4.1 for electrical connections.

2.7.2 DC Power Input Connector

The DC power input connector is a chassis mounted 2-pin "MATE-LOC" style connector (AMP 1-480699-0 or equivalent) with pin contacts at the rear of the Monitor. Connections are insulated to insure no accidental contact.

2.8 LCD Controller Board

The LCD Controller Board incorporates components necessary to drive the LCD Panel (Section 6.7). Accepting VGA and VESA video standards (Section 1.2), these video signals are digitized and processed for the LCD Panel. Due to the LCD Panel's fixed video resolution (800 x 600), the LCD Controller Board will perform independent horizontal and vertical zoom and shrink scaling of specified video resolutions less than or greater than the LCD Panel's video resolution to fully accommodate the LCD Panel's capability.

Magnification or reduction of specified video resolutions to match the native LCD Panel's resolution incorporates scaling algorithms minimizing aliasing and image distortion. The LCD Controller Board includes the following characteristics:

- Per pixel scaleable filters providing text sharpening and graphics smoothing for improved image quality.
- Color depth enhancement by performing spatial-temporal dithering reducing visual artifacts.

2.9 Grounding

Two (2) types of ground are provided: Chassis and Signal ground.

2.9.1 Chassis Ground

The chassis ground is a conductor that is grounded to the earth within user circuitry. It is not used for current carrying purposes. It is used only for non-current carrying purposes such as electromagnetic compatibility (EMC).

2.9.2 Signal Ground

Signal ground is electrically connected to chassis ground via the LCD Panel. However, there are no DC currents carried through this interconnect.

2.10 External And Internal Controls

A single external "Video Gain" control compensates for the white state (full white) video signal level range specified in Section 4.2.1 in achieving sixty-four (64) shades of gray.

External horizontal and vertical image positioning control(s) are provided to accommodate for the undefined delay between sync and video data edge referred to as Front Porch / Back Porch in Figure 9.

3.0 Environmental

3.1 Temperature and Humidity

The Monitor withstands operating and storage environmental conditions listed in Table 1.

	General Operating	Shipping and Storage	Comments
Temperature	0°C to 60°C [32°F to 140°F]	?-20°C to 60°C [?-4°F to 140°F]	Note 2,3,4,5
Relative Humidity	Note 1,4	Note 1	Without Condensation

Table 1. Temperature / Humidity Limits.

Tair is defined as ambient air temperature surrounding Monitor.

Note 1: Tair < 32°C : 95% RH maximum.
Tair > 32°C : Absolute humidity content not to exceed 100% at 32oC.

Note 2: Tair @ -20°C < 48 hours
Tair @ 60°C < 168 hours

Note 3: Slight background color changes are allowed depending on ambient temperature. This phenomenon is reversible.

Note 4: Tair @ -30°C : 15% RH (exterior face of Vandal Shield)
Tair @ 54°C : 100% RH (exterior face of Vandal Shield)

Note 5: Upper operating temperature limit of 60°C is without solar loading. See section 3.2 for operating temperature conditions with solar load.

Reference to "room ambient" is interpreted as 20°C - 25°C [68°F -77°F] and applies throughout this specification unless otherwise noted.

Excluding the exterior face temperature range of the Vandal Shield (Note 4), this Monitor will not be subjected to environments outside of the limits of Table 1.

For product reliability predictions, the assumed temperature profile is:

Operating Time	Temperature
5%	0°C [32°F]
90%	30°C [86°F]
5%	60°C [140°F]

3.2 Solar Loading

The Monitor is useable in an environment consisting of a 50 °C ambient air temperature and the following input solar power.

Power spectrum is referenced per MIL STD 810 E Environmental Test Method 505.3, Table -II Spectral Energy Distribution and permitted tolerances

Maximum solar power flux = 1120 watts/m² at 65 degrees normal to the Monitor surface.

These values assume no solar radiation attenuation from the customer-supplied vandal shield.

3.3 Altitude

Maximum operating altitude is 3,000 meters [9,850 feet]. Maximum shipping and storage altitude is 12,000 meters [39,400 feet].

3.4 Mechanical Vibration and Shock

Note: Tests performed with unpackaged Monitors are mounted in a Planar approved rigid retaining fixture.

3.4.1 Vibration

Non-Operating (sinusoidal): 10-200 Hz, 0.9g acceleration, 120 seconds per sweep for 15 minutes, three axes, (x, y, z).
Following exposure unit shall meet all performance requirements.

Non-operating (random): 10-200 Hz, 0.02g²/Hz, 10 min/axis, three (x, y, z).
Following exposure unit shall meet all performance requirements.

3.4.2 Shock

Non-operating: 30 g, \geq 2.5 ms duration, ½ sine, 1 shocks per axis.
Following exposure unit shall meet all performance requirements.

3.4.3 Shock Packaged Product

Non-operating: 30 inch free fall or simulated drop, 1 drop per side, 6 sides and 1 drop per edge, 3 edges 1 shocks per axis.
With accelerometer attached to center of product display screen, a maximum of 50 G's is allowed.
Following exposure unit shall meet all performance requirements.

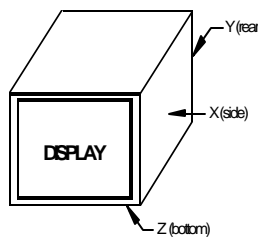


Figure 3. Monitor unit orientation 1

4.0 Video Signal Input Requirements

4.1 Video Input Lines

The Video Signal Connector consists of fifteen (15) positions wired numerically and supplied attached to the Monitor as a chassis mounted connector per definitions listed in Table 2. The "NC" positions of this connector are not used for any purpose.

Pin Number	Signal Name
1	Red Video
2	Green Video
3	Blue Video
4	Monitor Sense Line 3 (connected to Pin 10)
5	NC
6	Red video return
7	Green video return
8	Blue video return
9	NC
10	Signal Ground Reference
11	Monitor Sense Line 1 (connected to Pin 10)
12	Monitor Sense Line 2 (NC)
13	Horizontal Sync Input
14	Vertical Sync Input
15	NC

Table 2. Video Signal Connector – Pin Number Assignments

The Video Signal Connector that connects to the customer's equipment is a female 15-pin connector in a high density 9-pin D-Shell housing. Pin number assignments are defined in Table 2, and physical layout as seen by the interface cable from user logic is shown in Table 4.

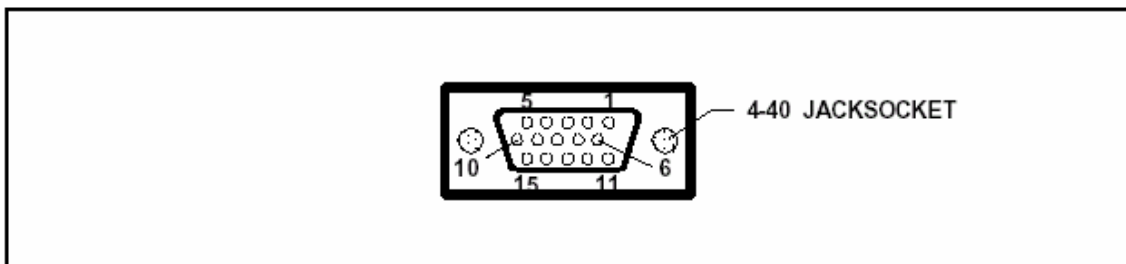


Figure 4. Video Signal Connector Illustration

4.2 Signal Functions

4.2.1 Video Parameters

As seen by the source, input resistance is 75-ohm, $\pm 10\%$; input capacitance at (150 MHz) < 10 -pF.

Coaxial cable is provided for video signal line(s) to match impedances and for EMI attenuation. The video input signal will have a range of 0-mv to 714-mv (maximum)

where 0-mv is minimum luminance. Rise and fall times for the input signal (10% - 90%) will be 75-ns (Figure 6).

When terminated with a 75-ohm termination, the dark state (black level) is defined as a level between 0-mv and 10-mv. The white state (full white) is dependent on the VGA controller driving the Monitor. Maximum levels may range from 550-mv to 714-mv. Nominal 680-mv input voltage shall be defined as the default for supplier setup requirements.

Displayed image intensity and colors will change linearly with the video analog input. This is necessary to provide a uniform user color change on the screen in response to a uniformly stepped analog input. The Monitor must be capable of resolving a minimum color range of 262,144 displayable colors (6 bit resolution for Red, Green and Blue). This interpolates to 64 shades of gray (or color) at the Red, Green, and Blue analog video inputs. Accomplishing specified shades of gray requires a "Video Gain" control adjustment (Section 15.0) of Red, Green, and Blue analog input signals based on the maximum output level range previously specified.

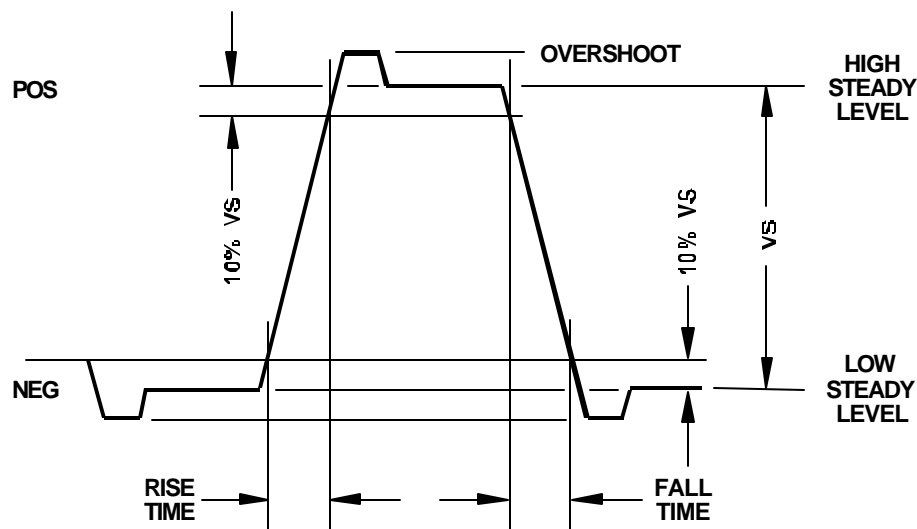


Figure 5. Rise / Fall Time

4.2.2 Synchronization

Sync pulses for horizontal and vertical are TTL levels. Figure 8 defines the levels and drive current capabilities.

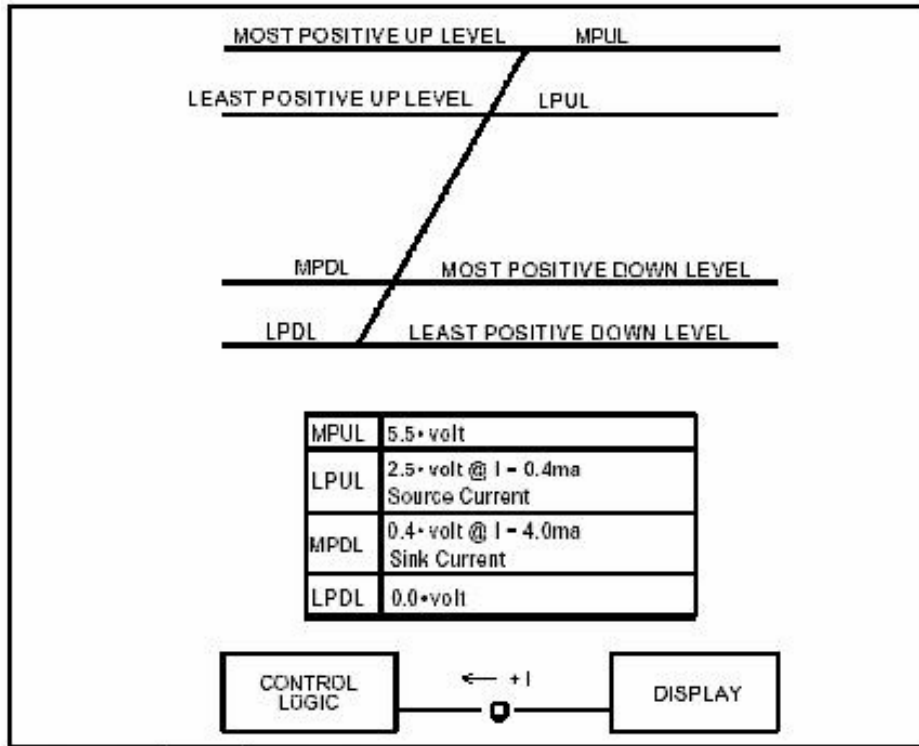


Figure 6. TTL Allowable Signal Levels

4.2.2.1 Mode Detection

The polarity of incoming horizontal/vertical frequencies and synchronization pulses define the video resolution being presented. Video modes are listed in Table 3.

Video Mode	Displayed Image Resolution	Scanning Frequency)		Sync Polarity	
		Horizontal (KHz)	Vertical (Hz)	Horizontal	Vertical
IBM VGA	640 x 400	31.468	70	-	+
IBM VGA	640 x 480	31.468	60	-	-
IBM VGA w/Border	656 x 496	31.468	60	-	-
IBM VGA	720 x 400	31.468	70	-	-
IBM VGA w/Border	738 x 414	31.468	70		
VESA	800 x 600	48.077	72	+	+
VESA	1024 x 768	56.48	70	-	-

Table 3. Video Mode Definitions

4.2.2.2 Color Display Detection

The video signal source determines which type of display is connected to it based on the state of the Monitor Sense Lines. The Monitor will indicate to the source that it is a "color display" when Monitor Sense Line 1 (Pin 11) is

physically connected to Signal Ground Reference (Pin 10) as defined by the wiring definitions of Table 2.

4.3 Signal Quality

4.3.1 TTL Sync Pulse Signal Levels

Input levels for the horizontal and vertical sync pulses are defined in Figure 8.

4.3.2 Rise and Fall Times

Rise and fall times are the times required for signal transitions between 10% of V_s above Low Steady Level and 10% of V_s below High Steady Level where V_s is the peak-to-peak video input signal level. The overshoot, if present, shall be exempted from establishing these high/low levels referenced in. Both rise and fall times of each input signal shall be as follows:

Video:	Less than 5-ns
Horizontal Sync:	Less than 50-ns
Vertical Sync:	Less than 100-ns

4.4 Timing and Frequency

4.4.1 Video, Horizontal And Vertical Sync

Figure 6 illustrate video timing relationships the Monitor operates within when the specified video mode (per Table 3) is applied.

Front Porch defines the time from end of active video data to the start of Horiz/Vert Sync Pulse.

Back Porch defines the time from end of Horiz/Vert Sync Pulse to the start of active video data.

Blanking is the total time comprising Front Porch, Back Porch and Sync Pulse time(s).

The horizontal sync circuitry synchronizes to horizontal frequencies of 31.468 KHz ± 0.5 KHz, 48.077KHz ± 0.5 KHz, and 56.476KHz ± 0.5 KHz. Horizontal sync pulse width variation is 1.813- μ sec to 3.813- μ sec. The Monitor will "sync" to the specified format vertical frequencies between 60Hz-72Hz without adjustment.

Absence of Horizontal and/or Vertical Sync will not damage the Monitor nor violate EMI radiation limits specified herein.

4.5 Video Signal On-Off Sequences

The sequence for bringing up and removal of each video input signal can be in any sequence or combination of input signals.

	Video Modes			
	IBM VGA		VESA	
	640x400	640x480	800x600	1024x768
Resolution	640x400	640x480	800x600	1024x768
Video Clock	25.175 MHz	25.175 MHz	50.000 MHz	75.000 MHz
Horizontal Scan Freq.	31.468 KHz	31.468 KHz	48.077 KHz	56.476 KHz
Horizontal Line Period	31.778 us 800 pixels	31.778 us 800 pixels	20.800 us 1040 pixels	17.707 us 1328 pixels
Horizontal Blanking	6.356 us 160 pixels	6.356 us 160 pixels	4.800 us 240 pixels	4.053 um 304 pixels
Horizontal Sync Pulse	3.813 us 96 pixels	3.813 us 96 pixels	2.400 us 120 pixels	1.813 us 136 pixels
Horizontal Front Porch	0.636 us 16 pixels	0.636 us 16 pixels	1.120 us 56 pixels	0.320 us 24 pixels
Horizontal Back Porch	1.907 us 48 pixels	1.907 us 48 pixels	1.280 us 64 pixels	1.920 us 144 pixels
Horizontal Active Display	25.422 us 640 pixels	25.422 us 640 pixels	16.000 us 800 pixels	13.653 us 1024 pixels
Horizontal Sync Polarity	-	-	-	-
Vertical Scan Freq.	70.087 Hz	59.94 Hz	72.184 Hz	70.069
Vertical Frame Period	14.268 ms 449 lines	16.683ms 525 lines	13.853 ms 666 lines	14.272 ms 806 lines
Vertical Blanking	1.557 ms 49 line	1.430 ms 45 line	1.373 ms 66 lines	0.673 ms 38 lines
Vertical Sync Pulse	0.064 ms 2 lines	0.064 ms 2 lines	0.125 ms 6 lines	0.106 ms 6 lines
Vertical Front Porch	0.381 ms 12 lines	0.318 ms 10 lines	0.770 ms 37 lines	0.053 ms 3 lines
Vertical Back Porch	1.112 ms 35 lines	1.049 ms 33 lines	0.478 ms 23 lines	0.514 ms 29 lines
Vertical Active Display	12.711 ms 400 lines	15.254 ms 480 lines	12.480 ms 600 lines	13.599 ms 768 lines
Vertical Sync Polarity	-	-	-	-

Note: VGA border is not included in the Active Display time described above.

	VIDEO MODES							
	IBM VGA				VESA			
RESOLUTION	640 x 400		640 x 480		800 x 600			
Video Clock	25.175MHz		25.175MHz		50.000MHz			
Horizontal Scan Frequency	31.468 KHz		31.468 KHz		48.077 KHz			
Horizontal Line Period	31.778 μ s	800 dots	31.778 μ s	800 dots	20.800 μ s	1040 dots		
Horizontal Blanking	6.356 μ s	160 dots	6.356 μ s	160 dots	4.800 μ s	240 dots		
Horizontal Sync Pulse	3.813 μ s	96 dots	3.813 μ s	96 dots	2.400 μ s	120 dots		
Horizontal Front Porch	0.636 μ s	16 dots	0.636 μ s	16 dots	1.120 μ s	56 dots		
Horizontal Back Porch	1.907 μ s	48 dots	1.907 μ s	48 dots	1.280 μ s	64 dots		
Horizontal Active Display	25.422 μ s	640 dots	25.422 μ s	640 dots	16.000 μ s	800 dots		
Horizontal Sync Polarity	-		-		+			
Vertical Scan Frequency	70.087 Hz		59.94 Hz		72.187 Hz			
Vertical Frame Period	14.268 ms	449 line	16.683 ms	525 line	13.853 ms	666 line		
Vertical Blanking	1.557 ms	49 line	1.430 ms	45 line	1.373 ms	66 line		
Vertical Sync Pulse	0.064 ms	2 line	0.064 ms	2 line	0.125 ms	6 line		
Vertical Front Porch	0.381 ms	12 line	0.318 ms	10 line	0.770 ms	37 line		
Vertical Back Porch	1.112 ms	35 line	1.049 ms	33 line	0.478 ms	23 line		
Vertical Active Display	12.711 ms	400 line	15.254 ms	480 line	12.480 ms	600 line		
Vertical Sync Polarity	+		-		+			

Note: For video mode 720 x 400 missing video rows and columns are allowed. This is a text mode only. Performance is acceptable if characters as defined section 1.2.1 are legible. Missing row or columns at edge of display is acceptable as long as characters remain legible.

5.0 DC Power Input Requirements

5.1 DC Power Input Lines

The DC Power Input Connector consists of two (2) positions wired numerically and supplied attached to the Monitor as a chassis mounted connector per definitions listed in.

PIN NUMBER	SIGNAL NAME
1	Most Positive Input Voltage
2	Most Negative Input Voltage

Figure 10. DC Power Input Connector- Pin Assignments

The DC Power Input Connector is a 2 pin MAT-N-LOK type with male pin contacts AMP 1 480699. Pin number assignments are defined in Figure 11; shown below is the physical layout as seen by the interface cable from the DC power source.

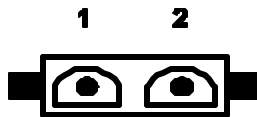


Figure 8. DC Power Input Connector Illustration

5.2 DC Input Voltage / Current

DC Input Voltage: 12 vdc nominal, ± 0.4 vdc.

Over the specified input voltage range:

- No loss of image synchronization occurs.
- White display luminance level is within 10% of luminance at nominal input voltage.
- DC Input Current: 4.3 amp maximum current draw (12.4-vdc applied) steady state conditions.

Refer to Figure 12 for required current profile characteristics at "power-up" conditions.

The Monitor is not damaged by input voltages ranging from 0-vdc to 12.4-vdc".

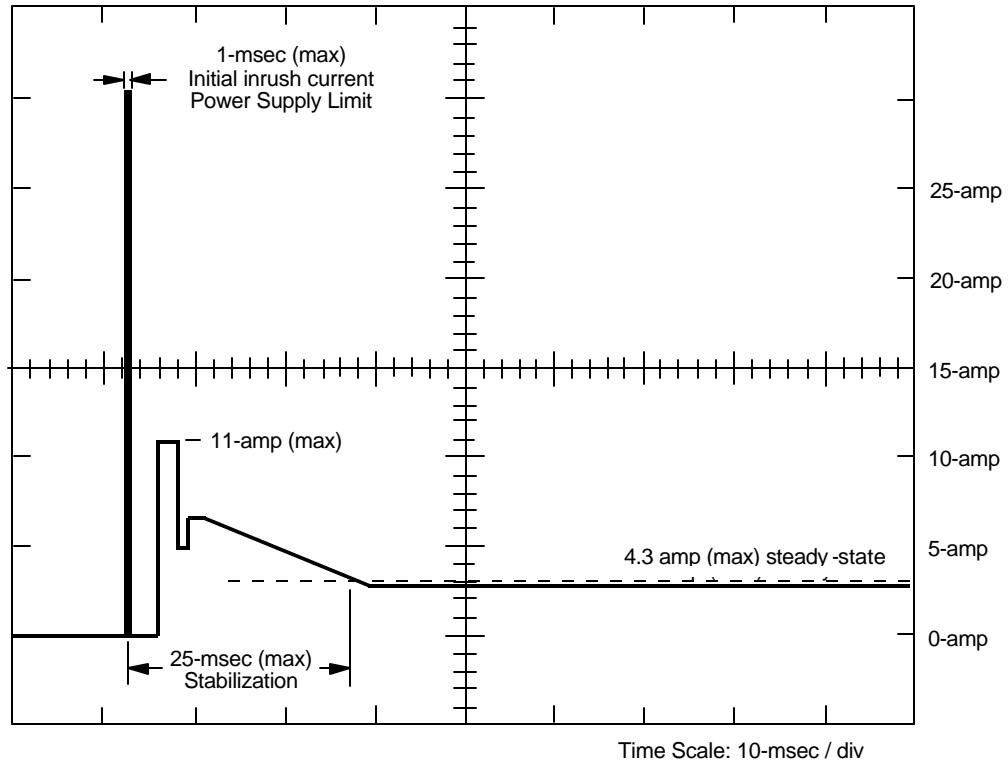


Figure 9. Current Profile: Note 3 amp figure is incorrect; use 4.3 amp as specified above.

5.3 Power On-Off Sequences

The Monitor will automatically return to normal operation upon resumption of power after a power loss.

6.0 Display Performance

6.1 Display Luminance

The display provides one level of luminance used for both daylight and night viewing.

Minimum white-light luminance at the screen center of the Monitor face is 1500 cd/m² [467 fL] in a darkened room environment with ambient light conditions less than 10 LUX [1fC] incident illumination and at room temperature. Reference: MIL-L-85762A (3.10.2.2.3). Luminance specification applies to the initial luminance, i.e. prior to additional operation in the end system.

$$\text{Luminance}_{\min} \geq 1,500 \text{cd/m}^2 [467 \text{fL}]$$

6.2 Display Contrast

Display contrast is a relationship between luminance levels and the ability to perceive a luminance difference. It is expressed as a ratio of ON white – luminance to OFF black background luminance generated by the display.

6.2.1 Room Ambient Contrast

Minimum Contrast of the display under room ambient lighting conditions of 1076 LUX [100 fc] direct incident illumination, is $\geq 90:1$. Reference MIL-L-85762A (Table II).

6.2.2 High Ambient Contrast

Minimum Contrast of the display in a diffuse off-axis illumination of 86,080 LUX [8,000 fc] and a specular on axis luminance (sky) of 6,853 cd/m² [2000 fL] is $\geq 6:1$. Reference MIL-L-85762A (Table II).

6.3 Display Uniformity

Luminance Uniformity (U) measured within 30 mm from edge of the display image area is $\pm 40\%$ of the luminance measured at the center of the display screen.

6.4 Display Chromaticity

The metric used for color coordinate determination is the CIE 1976 UCS (Uniform Chromaticity Scale) u', v' system.

Color determination is performed normal to the display in a dark room environment with ambient light conditions less than 10 LUX [1fc] incident illumination.

The measured u', v' color coordinates at room temperature for White-light and the Red, Green, and Blue primaries are listed for reference purposes only.

Color	u'	v'	Perceived Color
Red	0.449	0.517	Red
Blue	0.144	0.299	Blue
Green	0.142	0.559	Yellowish-Green
White	0.215	0.489	Warm White

White color is concentrated around 5600°K color temperature.

6.5 LCD Panel - Physical Image Characteristics

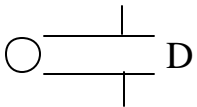
- The Monitor incorporates a matrix display with the following features:
 - LCD Size: 307.5mm [12.11in] diagonal
 - Active Area: 246.0mm [9.69in] by 184.5mm [7.26in]
 - Pixel Format: 800 (H) x 600 (V) (1 full color pixel = R + G + B dots)
 - Pixel Pitch: 0.3075mm [0.012in] horizontal x 0.3075mm [0.012in] vertical
 - Pixel Arrangement: R,G,B vertical stripe

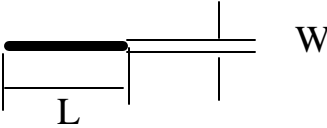
7.0 Display Cosmetics

All defects, pixel related and non-pixel related are observed at 46 cm [18"] viewing distance under room ambient light intensity 400-600 lux (fluorescent or incandescent lighting). Viewing time is specified as 5 seconds. The following criteria applies to active area of display.

Random Single Pixel Defects	Qty Allowed		Separation Allowed	
Bright Defects (Pixels) White Screen	Red, Green, Blue	Max. 10	Red, Green	Min. 0.200"
			Red, Blue	Min. 0.200"
			Green, Blue	Min. 0.200"
Dark Defects (Pixels) Black Screen	Red, Green, Blue	Max. 10	Red, Green	Min. 0.040"
			Red, Blue	Min. 0.040"
			Green, Blue	Min. 0.040"

Adjacent Pixel Groups	Qty Allowed (Pairs)		Qty Allowed (Triplets)	
Bright Defects (Pixels) White Screen	Red, Red	Max. 2 All colors	Red, Red, Red	Max. 0 All colors
	Green, Green		Blue, Blue, Blue	
	Blue, Blue		Green, Green, Green	
Dark Defects (Pixels) Black Screen	Red, Red	Max. 4 All colors	Red, Red, Red	Max. 0 All colors
	Green, Green		Blue, Blue, Blue	
	Blue, Blue		Green, Green, Green	

Non-Pixel Defects	Qty Allowed	Size	Separation	Defect Description
Circular Dark Defects Contamination	0	>.020"	-	
	1	.010 < D < .020"	-	
	4	.005" < D < .010"	.100"	
	Not cause for rejection	<.005"		

Non-Pixel Defects	Qty Allowed	Size	Separation	Defect Description
Bright Line Defects Polarizer Scratch, Lint Contamination	0	L > 0.120" W > .010"	-	
	5	.020" ≤ L ≤ .120" .002" ≤ W ≤ .010"	.100"	
	Not cause for rejection	L < .020" W < .002"		

Notes: A bright spot is a subpixel which, when a black screen is being displayed, is visible through a 20% transmission ND filter to an unaided eye at least 45 cm [18"] away from the display surface in a dark room. Dark spots in which the dark spot area divided by the subpixel area is less than 1/3 are not counted.

8.0 Regulatory Agency Requirements

8.1 Safety Certification

The Monitor does not inhibit customer from certifying product to following safety standards:

UL 1950/CAN/CSA C22.2 No. 950-95 Safety of Information Technology, including electrical business equipment

- UL 291 Standard for Automated Teller Machine
- EN 60950 Safety of Information Technology, including electrical business equipment.

8.2 CE Marking (Declaration according to ISO/IEC Guide 22 and EN45014)

The Monitor does not inhibit customer from conforming to the following EC Directives:

Council Directive 73/23/EEC and 93/68/EEC (Latest Amendment) on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits is based on compliance with the following harmonized standards:

- EN 60950 June 2000
- EN 41003:1991

Council Directive 89/336/EEC, 92/31/EEC and 93/68/EEC (Latest Amendment) on the approximation of the laws of the Member States relating to electromagnetic compatibility is based on compliance with the following harmonized standards:

- Electromagnetic Emissions EN 55022 Class A: 1994

- Electromagnetic Immunity EN 50082 part 1:1992

8.3 RFI Emission Certification

The Monitor is certified to the following emissions standards when installed in customer product configuration:

- FCC, Part 15, Paragraph 15.107(b) and 15.109(b), Class A RFI emissions standard.
- EN 55022 Class A: 1994 ? Limits and measurements of radio interference characteristics of information technology equipment.
- IEC 1000 3-?2/1995; EN 61000-?3-2 Current Harmonic Tests
- IEC 1000 3-?3/1995; EN 61000-?3-3 Voltage Fluctuation and Flicker Tests

8.4 System Transient Disturbance Requirements

The Monitor meets the following system transient disturbance requirements:

8.4.1 Electrostatic Discharge

The Monitor performs normally when subjected to static electricity discharges from persons touching the external surfaces of the Monitor. Performance is verified by testing according to EN 50082-1 (Ref IEC 801-2:1984) at severity level 3 (4 Kv contact discharge, 8 Kv air discharge).

8.4.2 Electromagnetic Energy Susceptibility Requirements

The Monitor performs normally in an electromagnetic field with a strength of 10- volts per meter from 10 KHz to 1 GHz. (REF CISPR 22).

The Monitor with appropriate cables is designed to comply with applicable EMC and Safety standards as noted in sections 2.31 and 2.3.2.

8.5 Labeling

Where applicable, the Monitor complies with IEC 60417 – Graphical Symbols for Use on Equipment

8.6 Color Coding

Where applicable, the Monitor complies with ISO 3864 – Safety colors and Safety Signs

9.0 Reliability

9.1 Design Workload

The Monitor is capable of operating 24 hours a day, 365 days a year under the specified environmental conditions per section 3.1.

9.2 Critical Failures

Critical failures is defined as failures that render the Monitor inoperable to the end user. The MTBCF (Mean Time Between Critical Failures) value excludes the fluorescent backlight assembly which requires periodic replacement and assumes periodic cleaning of air filtration screens to ensure adequate air flow for cooling.

The Monitor MTBCF is > 40,000 hours.

Note: MTBCF excludes fluorescent tubes from calculation. Calculation is made per MIL Reliability Handbook 217 Method 3.

9.3 Failure Definition

In general, the term failure denotes a fully functional Monitor unit ceasing to function within its required performance capability because of conditions internal to the Monitor unit. The requirements of Section refer to critical failures, defined and distinguished from others as follows:

Monitor Failure - Monitor ceases full operation. The failure cannot be corrected without at least one of the following: tools, test equipment, replacement parts, checks of the Monitor unit, and knowledge beyond performing routine operations.

Nuisance Failure - A component in the Monitor unit has ceased operation but does not impair the required operation of the unit.

Not Machine Failures - Malfunctions attributable to the following causes shall not be classified as failures:

- Improper installation or maintenance
- Abuse or misuse
- Exposure to environments outside the specified design range.
- Lack of prescribed preventative maintenance.
- Failures caused by test equipment used to control cycle and check the operation of Display units on test.

10.0 Description of Warranty

Seller warrants that the Goods will conform to published specifications and be free from defects in material for 12 months from delivery. To the extent that Goods incorporate third-party-owned software, Seller shall pass on Seller's licensor's warranty to Buyer subject to the terms and conditions of Seller's license.

Warranty repairs shall be warranted for the remainder of the original warranty period. Buyer shall report defect claims in writing to Seller immediately upon discovery, and in any event, within the warranty period. Buyer must return Goods to Seller within 30 days of Seller's receipt of a warranty claim notice and only after receiving Seller's Return Goods Authorization. Seller shall, at its sole option, repair or replace the Goods.

If Goods were repaired, altered or modified by persons other than Seller, this warranty is void. Conditions resulting from normal wear and tear and Buyer's failure to properly store, install, operate, handle or maintain the Goods are not within this warranty. Repair or replacement of Goods is Seller's sole obligation and Buyer's exclusive remedy for all

claims of defects. If that remedy is adjudicated insufficient, Seller shall refund Buyer's paid price for the Goods and have no other liability to Buyer.

All warranty repairs must be performed at Seller's authorized service center using parts approved by Seller. Buyer shall pay costs of sending Goods to Seller on a warranty claim and Seller shall pay costs of returning Goods to Buyer. The turnaround time on repairs will usually be 30 working days or less. Seller accepts no added liability for additional days for repair or replacement.

If Seller offers technical support relating to the Goods, such support shall neither modify the warranty nor create an obligation of Seller. Buyer is not relying on Seller's skill or judgment to select Goods for Buyer's purposes. Seller's software, if included with Goods, is sold as is, and this warranty is inapplicable to such software.

SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE

11.0 Support and service

Planar is a US company based in Beaverton, Oregon and Espoo, Finland with a worldwide sales distribution network. Full application engineering support and service are available to make the integration of Planar displays as simple and quick as possible for our customers.

RMA Procedure: For a Returned Material Authorization number, please contact Planar Systems, Inc., with the model number(s) and original purchase order number(s). When returning goods for repair, please include a brief description of the problem, and mark the outside of the shipping container with the RMA number.

Planar Systems, Inc.

Customer Service

24x7 Online Technical Support: <http://www.planar.com/support>

Americas Support

1195 NW Compton Drive

Beaverton, OR 97006-1992

Tel: 1-866-PLANAR1 (866) 752-6271

Hours: M-F, 5am - 5pm Pacific Time

Europe and Asia-Pacific Support

Olarinluoma 9 P.O. Box 46

FIN-02201 Espoo, Finland

Tel: +358-9-420-01

Hours: M-F, 7:00am - 4pm CET

12.0 Glossary of Terms and Abbreviations

Aspect Ratio: The ratio of width to height of a display surface. The standard television aspect ratio is 4:3.

Back Porch: The portion of a composite display signal which lies between the trailing edges of a horizontal sync pulse and the corresponding blanking pulse.

Black Level: The display-signal level corresponding to a specified limit for black peaks.

Blanking: The process of decreasing (or increasing) the display-signal level so that no visible retrace will appear on the display screen.

Blanking Level?? The level of a composite display signal which separates the range containing display information from the range containing synchronizing information. Also called the pedestal level, or blacker-than-black.

Brightness: A psycho-physiological attribute of visual perception in which a source appears to emit or reflect more or less light. Its psycho-physical, photometric equivalence is luminance.

Candela-per-meter-squared [cd/m²]: The international unit of luminance (nits).

Candle Power: Luminous intensity expressed in candelas.

CIE: Abbreviation for the Commission Internationale de l'Eclairage, formerly referred to as the International Commission on Illumination (ICI).

Chrominance: The colorimetric difference (dominant wavelength and purity) between any color and a reference "white" of equal luminance. In three-dimensional CIE color space, chrominance is a vector which lies in a plane of constant luminance.

Chromaticity: The color quality of light which is defined by its dominant wavelength and purity (see Chrominance).

Chromaticity Value: The scalar value of any one component of a three-component color (also called a tristimulus value). The unit value of each component is the amount of that component added to the other two components to produce a reference "white".

Color Data: The programmed values which determine the amplitudes of the signal which drive a color display.

Color Saturation: A psycho-physiological measurement of the degree to which a color appears to be free of white light.

Color Temperature: The temperature to which a black body must be heated to produce a color matching that of the source.

Contrast: The ratio between the maximum and minimum luminance values of a display.

dB (Decibel): A measure of the ratio of two signals. The dB value is $20 \times \log_{10}$ of a voltage or current ratio or $10 \times \log_{10}$ of a power ratio.

Foot-Candle [fC]: A unit of illumination equal to the illumination which occurs when uniformly distributed luminous flux is impinging on an area at a rate of one lumen per square foot.

Foot-Lambert [fL]: A unit of luminance equal to the uniform luminance of a perfectly diffusing surface emitting or reflecting luminance flux at the rate of one lumen per square foot.

Front Porch: The portion of a composite display signal which lies between the leading edges of a horizontal blanking pulse and the corresponding sync pulse.

Gray Scale: Variations in the luminance value of "white" light, from black to white. Shades of gray are defined as gray-scale graduations that differ by the square root of 2.

Illuminance: The density of luminance flux impinging on a surface. It is the quotient of the flux divided by the "apparent" or projected area of the surface.

Image: A displayed view of one or more objects or parts of objects.

Lambert: A unit of luminance equal to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square centimeter.

Luminance: Luminous intensity reflected or emitted by a surface in a given direction per unit of apparent area. Measured in nits.

Lumen: The unit of luminous flux or rate of luminous energy flow. It is equal to the flux radiating through a unit solid angle (steradian) from a uniform point source of one candela.

Luminous Flux: The time rate of luminous energy flow, measured by its capacity to evoke a visual sensation. It is expressed in lumens.

Luminous Intensity: The luminous flux radiated by a point source. It is expressed in candela.

LUX: The international unit of illumination. One LUX equals one lumen per square meter.

MTBCF: Mean Time Between Critical Failure

Photometer: Any optical device which uses a comparison technique to measure luminous intensity, luminance, or illumination. An equality-of-brightness photometer is based on simultaneous comparison of adjoining visual areas; a flicker photometer compares successive stimuli in the same visual area.

Resolution: The number of addressable, controllable display or picture elements, or the number of hypothetical coordinate locations which can be used to position graphic elements on a display surface.

Shades of Gray: A division of the gray scale from black to white into a series of discrete luminance shades with a square-root-of-2 difference between successive shades.

SVGA- Super Video Graphics Adapter

Sync: A contraction of synchronous or synchronization.

Tristimulus Value: See Chromaticity Value and Color Data.

VESA: Video Electronics Standards Association

VGA: Video Graphics Adapter

White: The common usage word for high-luminance achromatic colors.

XGA: Extended Graphics Adapter

13.0 Revision History

REV	REF	DATE	PAGE	DESCRIPTION OF CHANGE	BY
A	---	14 Jan. 05	All	First release	S.Vahlsing