

Tiering the Planar EL640.480-AM1 Monochrome with the NL6448AC33-18 Series Color Displays

Application Note 600-02

This Application Note was written to assist system designers with the considerations associated with tiering an EL640.480-AM1 with an NL6448AC33-18. Mounting, cabling, and interfacing differences can be minimized through the techniques presented in this document.

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Introduction

The ability to tier a high-performance monochrome and color display offers the best opportunity for end product differentiation. To date, differences in mechanical and electrical specifications between Planar electroluminescent (EL) and various color active matrix liquid crystal displays (AMLCDs) have made this a very difficult proposition. It is Planar's objective to provide its customers with the tools and products they need to quickly and reliably develop a tiered product line.

With the introduction of Planar's ColorBrite line of AMLCD products, Planar will now provide tiering solutions around our industry leading monochrome EL and color AMLCD products. Customers can design a simplified product line with a minimal number of changes to allow the designer to simply drop in either a monochrome EL or color AMLCD display subsystem. Mounting, cabling, and interfacing differences can be minimized through techniques presented here.

This application note assists system designers with the considerations associated with tiering an EL640.480-AM1 with an NL6448AC33-18.

The NL6448AC33-18, or "NL33-18", and the EL640.480-AM1, or "EL-AM1", are both 640 x 480 displays with a dot pitch of 0.33mm. From a systems level, the differences can be separated into mechanical, electrical, environmental, and optical differences. Design requirements for all four areas are explored in this application note. Key design points for each category are provided at the beginning of each section.

This Application Note applies equally to the NL6448AC33-18, -18A, -24SO, -27, and -29 displays.

Mechanical Design

The x-y active areas of these two displays are exactly the same; all other mechanical dimensions are different. This section addresses considerations in mounting design, display depth, electrical adapter board and display orientation, which determine the mechanical design.

- Mounting locations are different for each display. Some method is required to allow either display to mount to the system.
- EL-AM1 is 10 mm thicker. This extra space must be allowed in the initial design to allow the product to use either the EL-AM1 or the NL33-18.
- The NL33-18 requires an external inverter. This inverter may be attached to a mounting bracket, or incorporated elsewhere in the design.
- The connectors on the two displays are very different and will require different video cabling.
- Viewing requirements should be considered to accommodate viewing angle limitations of the Thin Film Transistor (TFT) display.

Mounting Holes

Overlaying the two mechanical drawings and aligning the active areas results in the composite shown below (Figure 1) where the EL-AM1 is outlined in dashed lines and the NL33-18 is shown in solid lines. Unlike many notebook LCDs, the active areas are nearly symmetrical to the outer dimensions for both displays. Note that the major overall mechanical dimensions are similar but the mounting holes are in very different locations.

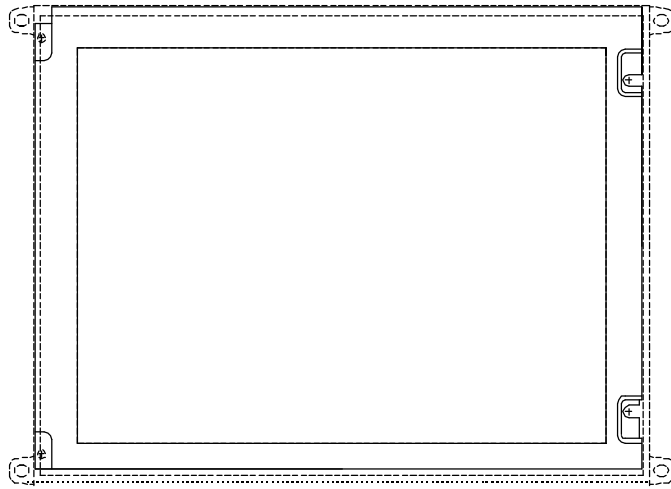


Figure 1. Mechanical Outlines.

Adequate distance between the various holes makes it possible to take advantage of the differences when designing the mounting enclosure to accommodate both displays. This spacing allows the designer to create two sets of independent mounting locations in the same enclosure. The dimensions should be chosen to provide optimum strength and support for each display. The example drawing below suggests locations, sizes, and heights of mounting standoffs for a tiered display system using either a molded or sheet metal enclosure.

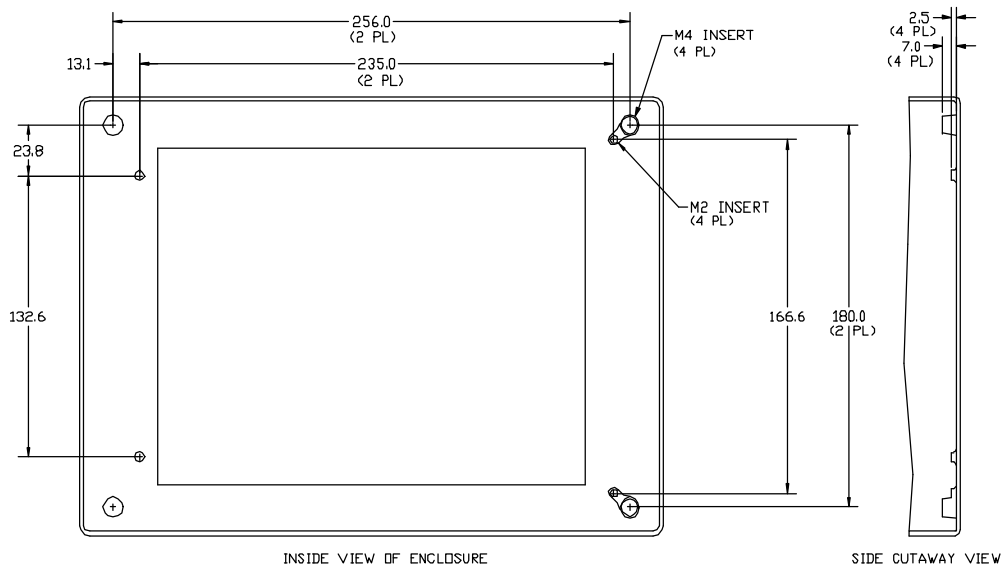


Figure 2. Example drawing.

Spacing Considerations

The front surface of each mounting tab on the EL-AM1 is 4.4 mm from the front of the display, and the front of the display must be mounted 2.5 mm from the front of the enclosure to avoid glass breakage. Because of this additional 2.5 mm gap, the NL33-18 mounting locations must be at least 2.5 mm high.

CAUTION: The NL33-18 mounting locations will interfere with the EL-AM1 display if the correct mounting heights are not considered.

The overall depth and spacing requirements of each display must be considered when designing the mechanical enclosure. The EL-AM1 is 20 mm thick and requires an additional 2.5 mm, while the NL33-18 is 10.5 mm thick. Please note that while the EL-AM1 display does not use all of this component envelope, future revisions may require rearrangement of some of the taller components. For this reason Planar suggests strict adherence to the specified component envelope across the entire display area.

Mounting Bracket

One mounting method which addresses the different mounting locations is the use of an adapter bracket that would allow the same basic enclosure to be used for either display. This approach is recommended because it allows future displays to be mounted without retooling the actual enclosure.

The mounting bracket must adapt the NL33-18 for use in an EL-AM1 mounting location, as shown in the example drawing in Figure 3. This example bracket would attach to the back of the NL33-18 with a screw and nut and to the EL-AM1 mounting locations with an M3 or U#4 screw.

Correct design of the bracket and attachment methods ensures performance under the displays' rated shock and vibration specifications.

This drawing is a preliminary concept drawing only.

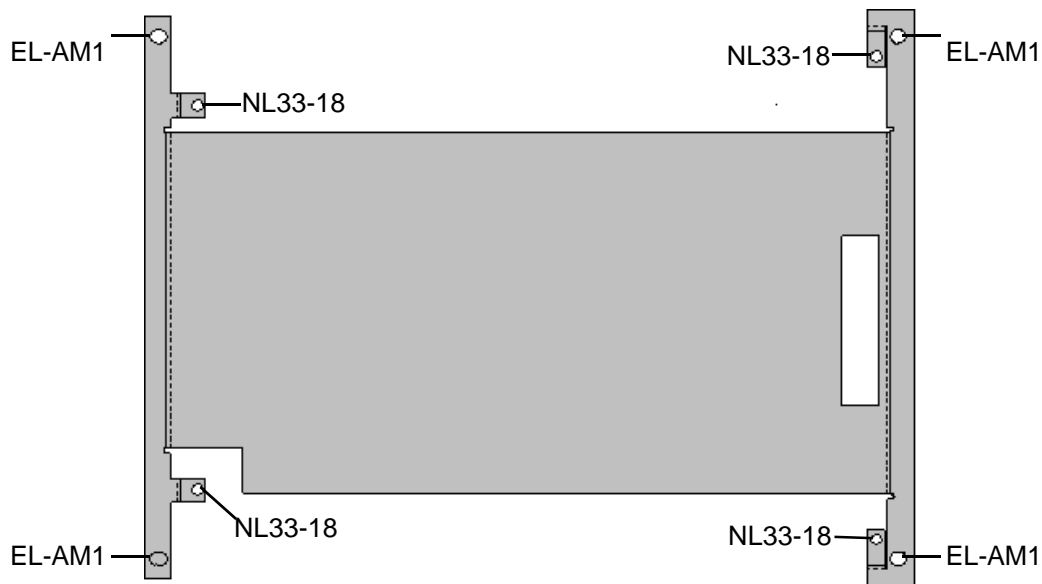


Figure 3. Example mounting bracket.

Inverter Position

The NL33-18 requires a backlight inverter which must be mounted near the backlight cable in the upper right corner of the display. This inverter is typically mounted along the right side of the display, thereby increasing horizontal width of the assembly. Alternatively the inverter may be incorporated into a bezel mounted over the rear of the display. In a tiering situation, the rear mount results in the optimal use of the extra space that would be present behind the NL33-18.

Viewing Angle

In some applications it may be desirable to optimize the viewing angle for the application. This is possible by rotating the NL33-18 by 180° and switching the electronics to correctly display the image in this rotated state. Refer to the specific AMLCD datasheet for details about the viewing angle and rotation selection.

Note: Choose the desired viewing angle characteristics for the TFT before designing the mounting enclosure to ensure the correct placement of the mounting locations. The EL-AM1 is completely symmetric around the viewing area and offers 160° viewing angle.

Electrical Design

- The video controller used must support either 18-bit TFT timing or dual-scan LCD timing.
- Provide a method for connecting to the 22 input signals and 2 power supplies required for both displays.
- Power supplies should be chosen to handle worst-case anticipated power draw of either display.
- Investigate dimming requirements and implement circuitry as required for either the digital style input on the NL33-18 inverter or the analog style input that is optional on the EL-AM1 display.

Interfacing and Connectors

Since the electrical interfaces and connector types are totally different, a method of adapting the different display connector configurations is required.

Both displays use standard interfaces that are supported by many of the popular display controllers. The system designer should ensure that the controller chosen can support either the dual-scan LCD mode as used on the EL-AM1 or the 18-bit TFT mode as used on the NL33-18. Contact Planar Applications Engineering for more information on BIOS requirements.

Once the proper controller has been selected, the correct cabling and connectors must be available for use with either display. The EL-AM1 uses a total of 11 input lines on a 20-pin Samtec connector, whereas the NL33-18 uses a total of 22 input lines over a 31-pin Hirose connector. If the system must support both the NL33-18 and EL-AM1, all of the signals shown in Table 1 and associated connectors must be available to support either display.

Table 1. Pin-out for EL-AM1 and NL33-18

Signal	EL-AM1/ -- 20-Pin Samtec		NL33-18/ -- 31-Pin Hirose	
	Pin Number	Description	Pin Number	Description
Clock	9	CP2	2	CLK
Horizontal Sync	11	CP1	3	HSync
Vertical Sync	13	S	4	VSync
Data Enable			27	DE
Power +5V	17,18	+5 V Power	28, 29	VCC
Power +12V	19, 20	+12 V Power		
Video Data 0	2	UD0	6	R0
Video Data 1	4	UD1	7	R1
Video Data 2	6	UD2	8	R2
Video Data 3	7	UD3	9	R3
Video Data 4	10	LD0	10	R4
Video Data 5	12	LD1	11	R5
Video Data 6	14	LD2	13	G0
Video Data 7	16	LD3	14	G1
Video Data 8			15	G2
Video Data 9			16	G3
Video Data 10			17	G4
Video Data 11			18	G5
Video Data 12			20	B0
Video Data 13			21	B1
Video Data 14			22	B2
Video Data 15			23	B3
Video Data 16			24	B4
Video Data 17			25	B5
GND	10,12,14,15,16	Ground	1,5,12,19,26	Ground

Power Considerations

Power draw of the displays is also an important consideration. The table below outlines the typical and maximum power requirements for each display system. Please note that the NL33-18 display connector does not require 12 V, but the associated inverter does. A 24 W maximum on the 12 V supply and up to 1.5 W maximum on the 5 V supply are required to ensure compatibility with either display under maximum load conditions.

Table 2. Power Limitations

Signal	NL33-18 Power (Watts)	EL-AM1 Power (Watts)	Limiting Specification (Watts)
Maximum Power +5 V	1.5	0.38	1.5
Maximum Power +12 V	5.8	24.0	24.0
Typical Power +5 V	1.0	0.20	1.0
Typical Power +12 V	5.8	11.0	11.0

Note: The EL-AM1 power is pattern-dependent. Worst-case, power is a checkerboard pattern; typical is a screen of Es.

Some applications may require luminance control, which can be achieved on the EL-AM1 using the optional dimming circuitry or on the NL33-18 using the luminance control input on the inverter. A digital input must be supplied to the inverter for the NL33-18. An analog input must be supplied to the EL-AM1. Consult the product Operations Manuals and Datasheets for detailed descriptions of the display's luminance control features.

Environmental Design

- Design around worst case conditions using the combined specifications for both the NL33-18 and the EL-AM1.
- Mounting design should ensure the displays' ability to retain shock and vibration performance.

Environmental Differences

The environmental design must be based on the lower-performance display. Alternatively you may choose to use the EL-AM1 in a more “rugged” system, since its performance is superior to the NL33-18. The table below outlines the key environmental differences between the two displays and the limiting environmental specification for each parameter.

Table 3. Key Environmental Specification

Specification	NL33-18	EL-AM1	Limiting Specification
Temperature operating storage	0 to +50 °C -20 to +60 °C	-5 to +55 °C* -40 to +75 °C	0 to +50 °C -20 to +60 °C
Humidity	< 95% @ +40 °C	< 93% @ +40 °C	< 93% @ +40 °C
Vibration	5 - 100 Hz, 2g	20 - 500 Hz, 0.02 g ² /Hz	5 - 100 Hz, 2g
Shock	55 g, 11 ms	100 g, 4 ms	55g, 11 ms
* Extended temperature ranges are possible (-40 to +65 °C).			

Optical Design

- Some form of physical protection is highly recommended for the NL33-18, but not necessary.
- Determine what the optimum viewing angle is for your application and adjust the NL33-18 accordingly

Optical Stackup

The optical stackup can be very similar for both the NL33-18 and EL-AM1. Neither have anti-glare or anti-reflective coatings, making them ready to use with the specific filters and touchscreens as required in a given application.

Note: Because the NL33-18 is a TFT display, any pressure applied directly to the active area will cause the liquid crystal to move, thereby causing temporary artifacts. These artifacts are not damaging to the display, but should be avoided through the use of a mechanical filter over the active area if possible.

Planar recommends the use of some form of physical protection on the viewing side of either display. In many cases this will be an acrylic or polycarbonate window that is mounted on the enclosure itself. This layer may incorporate an optical treatment or simply serve to protect the display from extraneous forces. Contact Planar Applications Engineering for specific recommendations. Both diffuse and specular reflectance requirements must be considered.

Viewing Angle

A secondary item (mentioned in the Mechanical Design section) relates to the vertical viewing angle. It is not symmetric, therefore the system designer should choose the viewing angle to the correct location for the application. The NL33-18 has a vertical viewing angle of +30 and -20 °C. Alternatively the display may be physically rotated by 180° to change the viewing angle to +20 and -30 °C. Dip switches on the display will change the orientation of the displayed image to correct for the rotation of the display. Consult the product Operations Manuals and Datasheets for more information. The EL-AM1 has a completely symmetric viewing angle and therefore no orientation corrections are necessary.

Summary

With proper initial planning, it is straightforward to design a product which utilizes either the NL33-18 or the EL-AM1. By creating a flexible mechanical mounting scheme and careful selection of the video controller, most of the compatibility issues are easily handled. The optical and environmental issues can easily be addressed with thorough attention to the end product environment.

Planar is continuously creating better tiering solutions to help systems designers meet their complex and demanding display needs. In addition, our Applications Engineers are available to offer other recommendations to ensure you the best display solution.

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