



## Guide to Selecting a Rugged or Custom LCD Display

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### Introduction

When is the last time you used any kind of device that did not have a display? Displays are no longer for showing a few key numbers; they have become the primary interface between the end user and the device. This fact applies just as much to industrial products as it does to consumer devices. Given this important role, it is surprising how often displays are just specified into a project once it is almost complete. You just create your widget and then snap in an “off the shelf” display and you are all set, right?

Treating display selection as an afterthought may have been appropriate 20 years ago when CRTs and basic graphics capabilities were the primary options. The situation is very different today with an incredible variety of display technologies and capabilities. There is much less standardization around one solution because no single display technology can handle the wide variety of requirements now expected of displays.

It is imperative that project teams give consideration to display specifications earlier in the project cycle. This provides more of an opportunity to develop a display solution that fits the unique needs and requirements of your project. Fortunately the process of selecting the right industrial display can be addressed relatively quickly by considering the audience, the information content and the environmental conditions in which the display will operate. This article will explore some of the key considerations and trade-offs in selecting the right rugged or custom LCD display.

Who will use it?

**Audience Size:** Will one person be using the display or does the content need to be viewed by many people at the same time? A display used by many people will likely need to be larger and will need a much wider viewing angle than one used by an individual.

**Audience Type:** Will the display be in a professional environment or be open to the general public? As many kiosk manufacturers have experienced, displays used by the general public can often be subjected to a lot of wear and tear and may need different types of ruggedization, such as vandal-proof glass.

What does it do?

**Embedded:** Will the display be embedded in an existing device or console or will it be attached to a piece of equipment? If it's embedded, what type of bezel is needed? Does the bezel need to communicate branding information? If the display is attached, what type of mounting, stand and brackets are needed.

**Graphics:** The type of content that is communicated will influence many other considerations. Is the content text-only or does it need to include graphics? How detailed are the graphics? Are the images static or moving? Certain display technologies are less susceptible to image sticking. Will video content be needed, and if so, will it be in digital or analog format?

**Size:** This is one of the most common considerations for any display project. The size of the display may be driven by the amount of available area on a device, but the project team must also refer to the content requirements above to make sure the selected size adequately addresses those needs. Size considerations extend beyond just the diagonal but must consider if the display will be in landscape or portrait mode. Now that video content is more widely used, does the display need to be in a widescreen format (16 x 9) as opposed to the traditional (4x3) or other custom dimensions. Wide screens have the advantage of fitting wider screens into previously smaller screen equivalent vertical height.

**Color:** This is one of the more misleading considerations. The typical reaction to this question is to always want more colors, but often this is not essential and it unnecessarily constrains a project. Does your project require 16 million colors or is it more important that highlight key information with an increased contrast ratio? Is monochrome acceptable or will spot color be more effective? Is transparency more important than multiple colors?



*Transparent electroluminescent display*

**Interface:** Will the end user need to control the device or manipulate information on the screen? Will the end user be wearing gloves? How many touches will the display receive over its lifetime? All of these considerations will impact your choice of touch technology: resistive, capacitive, infrared, SAW. Even if touch technology is incorporated in the display, are external buttons also needed as shortcuts to key areas of an application? Another interface consideration is the use of sound in communicating information to the user. What quality of sound is needed and does a microphone need to be included?



*Outdoor kiosks require sunlight readability and a touch interface*

**Power:** Knowing the power budget that the display can consume is one of the first considerations in selecting the display technology. For instance, a handheld device that uses battery power may not be able to utilize a bright backlight to illuminate the display. The designer may have to forgo a brilliant transmissive



AMLCD for a transfective or passive display technology. Additionally, power and thermal management often are related if the enclosure requires cooling or is subjected to a warm environment such as direct sunlight.

Where will it be used?

**Outside v. indoors:** What type of ambient light will the display experience? The difference between indoor and outdoor applications can lead to significantly different displays in terms of luminance, contrast ratio or backlights. A simple rule of thumb for AMLCD displays is that you will require at least 1,000 nits of brightness for direct sunlight view-ability. 500 nits are generally acceptable for bright ambient viewing; and 250 nits are fine for indoor viewing conditions. AMLCD structures are the most effective transmitters but

*Outdoor kiosks require sunlight readability and a touch interface*

they have poorer viewing angles than some of the alternatives. Outside applications often need to deal with direct sunlight and may require additional enhancements such as optical glass bonding or performance films for anti-reflective or anti-glare.

**Ruggedness:** Industrial displays frequently operate in conditions that require ruggedness. However, the specific nature of those conditions can influence where the design team should concentrate its efforts.

*Thermal Management:* What type of temperature range is required? Is there any difference in the requirements for operating or start-up temperature? Does the display need to turn on instantly no matter what the conditions?

*Shake & Shock:* How much vibration will the display experience? Are the vibrations constant or are they intense for short-periods of times. For rugged applications such as in vehicle or heavy equipment, the display mounting and assembly becomes very important. There are several MIL and IEC shock and vibration standards that are often cited depending on the application

*Vandalism:* Will the display need to be vandal proof? This is not just as simple as providing vandal-proof glass. Have you considered performance coatings for anti-glare or anti-reflection so as not to interfere the optical properties of the glass? Your choice of coating will be influenced by whether a touch screen is present. Do you want glass or plastic and are you aware of the possible birefringence affects.

*Dust:* Is there a lot of dust in the environment? If so, you may want to avoid fans or allow for easy replacement of filters. Does the airflow need to be monitored so the operator knows when to change the filter?

*Liquid:* How will your product be protected against liquid ingress? Most displays require a protective plastic or glass overlay. The addition of another surface between the viewer and the display can create internal reflections that lessen crispness. The external overlay also lessens light transmissivity by at least 8% if it is not optically bonded to the surface of the display. To obtain IP and NEMA ratings on touchscreen equipped systems, you must consider sealing methods and their impact upon the touchscreen sensor. IR, Resistive and capacitive touch screens can be easily sealed to prevent liquid ingress.

**Mobility:** Is the display fixed or mobile? If it's mobile, is it in a vehicle or in a handheld unit? This consideration will interact with many of the other requirements, influencing size, ruggedness and reliability.



**Reliability:** How many hours will the display need to last? Obviously, there is a big difference between 5,000 hours and 100,000 hours. Lamps are the key item that needs replacement. Will your choice of display technology limit the number of lifetime hours? Given the rapid rate at which technology gets upgraded, will display replacements need to have the exact same specifications in five or ten years? Configuration management is often more dependent on the vendor than the exact display technology selected, although AMLCD displays are more likely to have faster technology cycles and therefore may be less likely to have stable specifications.

*Mobile handheld unit designed for rugged testing environments*

**Standards & Certifications.** Whether you are designing a kiosk, a medical device, or anything in between; components that have safety certifications, FCC and CE will make it easier for you to achieve safety certification on the system you are designing. Many other standards may be considered including UL, CSA, IEC, FCC, and FDA requirements. Since we live in a worldwide marketplace, have you determined where you want to sell and ask your display vendors if they have certifications in countries where you intend to sell your product?

How much can you spend?

**Lifetime cost:** Display projects have budget constraints like any other project. What limitations are there on the initial display cost? Is there a budget limit for the lifetime cost of the display? Have you factored in installation and maintenance costs? What about service and replacements? Don't forget the hidden cost incurred if the wrong display is selected. For instance, one ATM service provider estimates that 10-15% of all possible transactions on their ATM do not occur because the public cannot see the ATM display in bright sunlight. Would your product have a better ROI if the display compelled the user to higher utilization rates?

**Disposal:** Have you factored in the cost of disposing or recycling the display? With increasing interest in sustainable and green solutions, you have to factor in these costs as part of the total solution.

## Conclusion

The exploration above only begins to capture the interactions between the various considerations for a display project. A project team should evaluate all the trade-offs involved in these decisions as there is not one perfect display technology that can meet all requirements. This complexity makes it important to evaluate your display requirements early in the project, and it requires working with vendors that can adapt their solutions to fit the interaction of numerous requirements.

The display is the crucial link between the end user, your device and the information that needs to run the device. As a result, the display component should get the attention it deserves rather than being treated as an afterthought in the design process. The complexity of display options available today makes this more important than ever.

For an interactive guide to defining and selecting a rugged or custom display, visit [www.planarembdedded.com/guide-to-custom-lcd](http://www.planarembdedded.com/guide-to-custom-lcd). This application will help you collect the answers you need for your project and will email you a summary of your project definition.