

display systems article

DÉJÀ VUE

Finding a Better Path to Specifying an Enhanced LCD to Meet Your RFQ

After the morning you've had—bad coffee, uncooperative kids, horrible commute—you're settled in at your desk (which you've styled to perfectly mimic the cockpit of an X-Wing starfighter) for another routine day at the office. Except, as you have just learned, this will not be another routine day at the office...



Your project manager bursts into the office, talking excitedly about an opportunity that has incredible potential for your organization. She drops a hefty stack of papers onto your desk and, just before walking out of the office, says that she knows you're the right person for the task. You, my friend, must spec out a new display for that upcoming military project.

As you begin the unenviable task of reading through the pages and pages of requirements, you start to get the nagging feeling that you've been down this path before. Sunlight readable? High contrast ratio? Antireflective coatings? Yes, yes, and yes. Oh, and don't forget: there's a wide variety of MIL-STD-810, -461 or -901 requirements in the request for pricing, as well. You wince as you recall a similar design that was plagued with reflection issues, poor contrast, and failed to meet the harsh ESS requirements necessary for that particular application.

Here's the diagnosis: You are experiencing "Déjà Vue." The widely accepted remedy for such an affliction is to find an improved solution to meet the rigorous requirements needed to land this new opportunity.

You may have heard a lot about optical bonding, but is it the right solution for your application? When examining an RFQ, there are key requirements included that determine if optical bonding will be the optimal solution.

WHEN THE RFQ CALLS FOR:

Augmentation of Optical Performance

Do you need to increase luminance and contrast beyond what is available "off the rack?" It is often assumed that if you want to increase the readability of a display, especially for an outdoor application, then you have to incorporate a backlight with an even higher brightness level. While this is often a viable solution, the added power consumption can be quite costly, as other factors must be taken into consideration. Increased heat emission often requires greater form factor for the inclusion of heat sinks, fans, and other cooling methods.

Optically bonding an overlay to the display, using an index matched adhesive, can dramatically reduce internal reflections, thereby increasing the contrast and readability of the display in high ambient light or direct sunlight.

Improved Ruggedization

Does the display need to meet severe harshness requirements? A bonded display assembly is typically able to withstand the high shock and vibration typically associated with MIL-STD-901, MIL-STD-810 and DO-160 requirements. In addition, rugged overlays can be optically bonded to a display for added protection in front of the LCD, discouraging vandalism. Highly resistant to impact, scratching, and chemicals, these overlays are available in several coatings to provide optimum viewing of a flat panel display based on the particulars of the application.

Extended Operating and Storage Temperature Ranges

Will the display be required to operate in extreme temperatures? Today's display users are finding it more common for their units to operate in extreme temperatures. Low temperatures can have adverse effects on display systems, which can temporarily or permanently impair the visibility and operation of the display. Through the use of an optically bonded LCD, coupled with an optical heater, temperatures down to -55°C are attainable.



WHAT EXACTLY IS OPTICAL BONDING?

Optical Bonding refers to the process of affixing two optical elements to one another using a liquid adhesive. The qualifier optical implies that the adhesive is transparent, has a suitable refractive index, and is made under adequate control such that there are no significant variations in the optical properties within a single bond. In this way, we differentiate **bonding** from **lamination**.

Through the use of optical bonding, the performance of a flat panel display can be enhanced dramatically. A multitude of optical, electrical or mechanical overlays can be incorporated into the design for added functionality. Below is a list of overlays commonly bonded to a display.

- » Contrast Enhancement Filters
- » Anti-Vandal Overlays
- » EMI-RFI Shields
- » Heaters
- » Touch Sensors
- » Privacy Filters



ADHESIVES

Silicone

With more than 30 years in the industry, the silicone adhesive bond has been used for both commercial and military applications. As a relatively soft material, bonding with silicone involves minimal risk, as any problems with the bond can be easily reworked. Adding to its popularity as a bonding adhesive, silicone meets a wide variety of display requirements; however, it does have some limitations when it comes to temperature and altitude. This bond is also best suited for bonding of glass overlays to the display.

UV Silicone and UV Acrylics

General Digital's latest proprietary ultraviolet (UV) bonding process will take you where no other silicone bond has gone before! UV bonding technology allows for wider operating temperature ranges than traditional silicone bonds. Our formulation will survive a wide range of temperatures, well suited for today's harsh environmental military applications.

In addition, our UV technology solutions have tested successfully in simulated altitudes in excess of 55,000 feet, with no bond degradation to the assembly. UV bond technology provides for a thinner bond line (measured in microns, not millimeters) than traditional silicone bonds, which will integrate seamlessly with your current system, requiring no mechanical dimensional modifications to accommodate the added bond thickness. The UV bonded solution is also an excellent choice when optically bonded overlays (other than glass overlays) are required.

BOND DESIGNS

Of course, optical bonding encompasses more than just the choice of adhesive; there is also the detail of the bond design. Numerous configurations are possible and there are several currently in use. These include **Over-the-Frame**, **In-the-Frame** and **Under-the-Frame**, as well as **Behind-the-Display** and **Frameless** designs. As with the different adhesives, each bond design has its own unique attributes.

Over-the-Frame and In-the-Frame bond designs require that the display first be sealed to the OEM metal frame, eliminating the possibility that adhesive might leak into the backlight and contaminate the films present. This design requires the use of a non-corrosive silicone formulation to effect this seal.

In Under-the-Frame, Behind-the-Display and Frameless bonds, the flat panel display must be disassembled before the bond can be made. After the bond has cured, either the OEM frame or a customer-designed frame is affixed to the display.



It should be noted that one caveat of the Under-the-Frame and In-the-Frame bonds is that they are not suitable for making a liquid-proof or drip-proof seal to the bezel of the monitor. To accomplish this, an Over-the-Frame bond offers the best results. This bond design is also required when used with an optically-bonded touch sensor. The nature of the overlay will often determine the details of the bond. However, in general, there is a gasket of some sort placed onto the face of the OEM frame, forming a well-defined bond thickness and protecting the edge of the seal from abrasion, which can result in the formation of debris.

More advanced display requirements will often necessitate the use of more than one overlay. Optical bonding, in its larger sense, concerns itself with the impact of each material in relation to the properties of every other material. An example would be the use of a conductive glass to control EMI, to which is bonded a touch sensor. Optically bonding these overlays provides additional functionality to the display and maintains readability for the user.

In the case of a true NEMA 4 enclosure or a display for use in CBW (Chemical and Biological Weapons) applications, where the display surface may be required to have the ability to be pressure washed, making a reliable seal to the bezel has traditionally presented a formidable challenge. The application of any significant amount of pressure on the mounting points of the flat panel display (typically two places on each short edge of the display) can cause the display to experience substantial stress, which is seen as bright or dark spots in the display background—even in a bonded display.

To overcome this, General Digital Optical Bonding Laboratories has developed, and applied for patents on, a design we call the XO-Fraim™. In this design, a rigid frame member is provided for clamping directly to the overlay glass at multiple points around the periphery. This frame serves as both a spacer and edge protector for the optical bond. The display is then attached to the frame using a double-sided gasket material and held in place with light clamping force applied to the four mounting points. This mitigates the issues of stress on the display by applying all of the sealing forces directly to the overlay glass.

We may not be doctors, but we've got the cure for what ails you! Whatever the application, General Digital's Application Engineers will consult with you on a customized bond configuration best tailored to your specifications, and assist you in winning new opportunities. Call 800.952.2535 now for a no-obligation consultation, or to learn more about our UV technology environmental testing results. Together, we can bring an end to Déjà Vue once and for all.



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