



Technology Brief — Getac QuadraClear™ Sunlight Readable Technology

Getac's Exclusive Backlight and Anti-Reflective Technology Combination Breaks New Ground

Screen Brightness and Anti-Reflective Technology Combine to Enable Daylight Viewability Six Times Better Than Competitive Solutions

Computer displays aren't valuable if you can't read them, and bright sunlight can easily make most screens nearly unusable. In order to avoid errors, diminished productivity, physical danger, and eye strain, highly visible displays are essential for users of rugged mobile devices, from law enforcement and military personnel to utility workers and in-vehicle deployments.

There are two conventional approaches to optimizing viewability—increasing the level of screen brightness and decreasing reflectivity (typically with anti-reflective screen coatings). A key issue with increasing screen brightness is that a brighter fluorescent backlight consumes dramatically more power, cutting battery life in portable devices. Anti-reflective coatings tend to be expensive; they can add to the cost of a touchscreen by as much as a factor of three to four. Both methods are significantly limited in their ability to improve display appearance in bright sunlight on their own.

Getac combines proprietary technologies for both screen brightness and anti-reflectivity to overcome these limitations. Its QuadraClear™ Sunlight Readable Technology enables display viewability that is more than six times better than competing solutions, while still maintaining the battery life required in a mobile device.

Super-Bright LED Backlights Save Power in Portable Devices

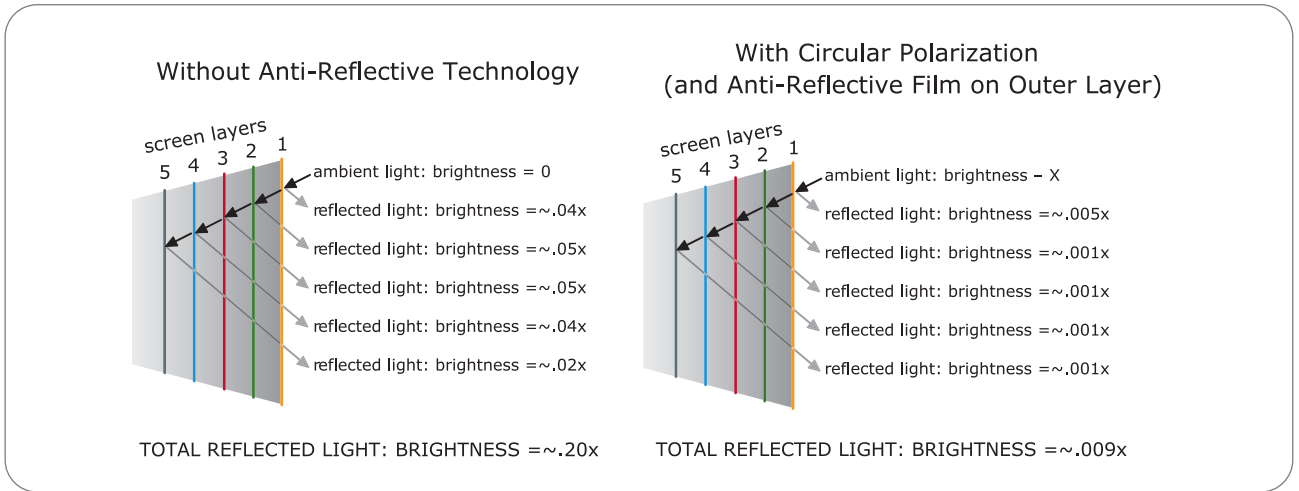
The core means of increasing outdoor viewability is to increase the contrast between the information being displayed and the sunlight being reflected by the screen. One simple "brute force" method is to increase the display brightness in an effort to compete with the sun.

Typical displays are generally in the range of 250 to 1,000 NITs (the unit used for brightness, one candela per m², is typically referred to as a NIT).

LEDs Overcome Fluorescent Limitations

Replacing fluorescent backlight sources with LEDs enables brighter, more efficient, and more reliable displays:

- **Energy Efficient:** LED display backlights can save significantly on power and heat, relative to CCFLs.
- **Mercury-Free:** Unlike CCFLs, LEDs contain no mercury, enabling regulatory compliance.
- **Durable:** The solid-state construction of LEDs tends to be more durable than glass-enveloped CCFLs.
- **Consistent:** LEDs have a superior profile to CCFLs in terms of deteriorating in brightness over time.



[figure 1] The reduction of reflected light enabled by circular polarization

Because of the power limitations mentioned above, it is difficult for manufacturers to go beyond these levels. To compensate for this power drain, default power schemes often automatically dim the display when it is on battery power, which is precisely when users need maximum display brightness.

Getac created a display backlight based on light-emitting diode (LED) sources to replace the cold cathode fluorescent lamps (CCFLs) that are commonly used. The less diffused light from an LED enables a power-efficient, super-bright display operating at 1,200 NITs, without sacrificing battery life or resorting to undesirable power-management schemes.

Active Anti-Reflective Process Superior to Coatings Alone

While the super-bright backlight technology is very valuable, Getac engineers know that it is only one part of the solution. Direct sunlight is typically in the range of approximately 10,000 to 100,000 Lux, significantly higher than displays. Touchscreen displays typically have five layers, and each untreated touchscreen layer reflects approximately four percent of the sunlight. Those reflections can easily overwhelm the brightest backlights alone, making anti-reflective technology vitally important to solving the issue of daylight usage.

Getac QuadraClear™ Sunlight Readable Technology uses an active anti-reflective process based on

circular polarization (see sidebar) to block reflected light, dramatically increasing viewability, even under the harshest daylight conditions. The net effect of this technique in reducing the amount of light reflected back from a display is shown in Figure 1.

On the left-hand side of Figure 1, approximately four percent of the light incident on each surface is reflected back (depending on the layer's composition), with an additive effect that results in as much as 20 percent of the ambient light being reflected back to the user. On the right, circular polarization blocks almost all reflection from the display layers behind the outermost layer. Combined with an anti-reflective coating on the outermost layer (saving considerable cost compared to putting coatings on all layers), this technology can potentially limit the total reflectivity to as little as 0.9%.

Combination of Technologies Results in Superior Viewability

As mentioned previously, the viewability of a display in bright sunlight is determined by the combination of display brightness and display reflectivity, which is often referred to as effective contrast ratio (ECR):

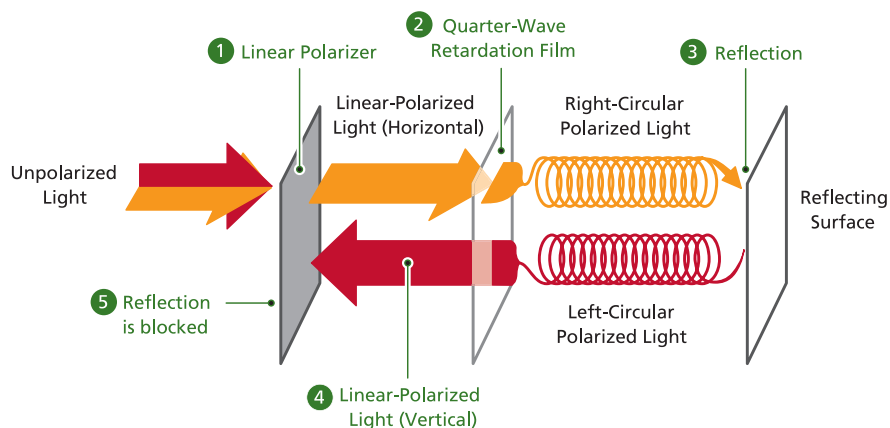
$$ECR = 1 + (\text{display brightness} / \text{reflected light})$$

In this relationship, display brightness is measured in NITs, and reflected light is expressed as the percentage of reflected ambient light (a higher ECR indicates better viewability).

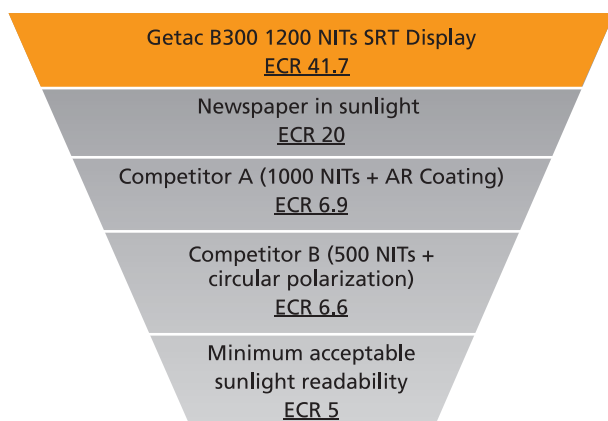
The Mechanism of Circular Polarization

The process of blocking reflections using circular polarization consists of the following steps, as depicted in the figure below:

1. Unpolarized light passes through a linear polarizer and becomes linear-polarized (along the horizontal axis in the image).
2. The polarized light passes through a quarter-wave retardation film, which delays its phase, making it right-circular polarized.
3. When the right-circular polarized light reflects off a surface, it changes orientation, becoming left-circular polarized.
4. When the left-circular polarized light passes back through the retardation film, it becomes linear-polarized again, but now along the opposite of its original axis (shown as vertical in the image).
5. Because the light is polarized on the opposite axis, it is blocked from passing back through the linear polarizer.



Analysis of the Getac B300 1200 NITs display reveals an ECR of 41.7^[*], compared to 6.6 and 6.9^[*] by the two competitors in the study. To put those numbers into context, consider the following illustration:



These results clearly indicate that Getac has broken new ground with its QuadraClear™ Sunlight Readable Technology, enabling a quantum leap forward in display readability for rugged mobile systems used in bright sunlight.

For more information, contact Getac at:
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[*] Measured under 10,000 lux ambient lighting condition by Getac.

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