



RUGGED NOTEBOOK DISPLAY VIEWABILITY



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Why Simply Brighter is Not Necessarily Better

The slightest amount of sunlight reflection, or non-office lighting conditions creates challenges that wash out the display rendering the image almost unreadable.

TECHNOLOGY APPROACHES TO IMPROVING DISPLAY VIEWABILITY

Recent improvements in display technology have taken small steps to overcome this limitation. The approach used by most manufacturers has been more “brute force” than sophisticated design. The industry’s ‘brute force’ method calls for simply increasing the display brightness (measured in NITs). By adding additional backlights NIT ratings quickly increased from 250 to 500 – and now to an eye-straining 1,000 NITs.

Contrast Ratio is Key to Outdoor Viewability

Since NIT ratings only measure brightness, they are a poor indicator of display viewability. In the field, users need to be able to distinguish fine details such as text and graphics in order to be effective. Increasing brightness simply does not address the most important technical challenges

Displays that incorporate multiple backlights to generate adequate light (1,000 NITs) to overpower direct sunlight are not the ideal solution one might think. While this is an improvement to standard technology the implementation has numerous weaknesses and customer trade offs which need to be considered before selecting a device for mobile workforces.

DynaVue is the only touchscreen display that follows DOD-STD-3009 guidelines by providing optimal viewability in all lighting conditions without sacrificing battery life.

- *Battery life suffers as more power is required to illuminate the display. To compensate for poor battery performance, some companies use low voltage processors which reduces processor performance, or they will reduce the brightness by over 50% when the unit is undocked.*
- *Contrast ratio and color saturation remain low in direct sunlight making it difficult to distinguish fine details such as text and map details.*
- *The extra light (NITs) overpowers the LCD pixels causing dark colors to appear grey and the image to become washed out.*
- *CCFL backlights dim over time (25% in the first year). Brightness degrades more over time with more backlights.*

nor does it indicate whether or not the display is truly viewable in bright sunlight.

Sunlight reflecting off the many layers of the touchscreen and LCD is the primary element that washes out the image making fine detail difficult to distinguish and colors to become muted. Reduce these reflections; both specular, (mirror like) and diffuse, (uneven) and you create a highly viewable display without increasing brightness.

Since NIT ratings are not an indicator of viewability, a more appropriate measurement of outdoor performance must be used. Contrast ratio; specifically high ambient contrast ratio,



is used to measure the viewability of displays mounted in military aircraft cockpits and provides a much clearer characterization of viewability. Measuring contrast ratio determines the level of detail that can be seen on the display, with the higher ratio providing richer color and crisper lineation. Commercial notebooks' contrast ratio is typically measured indoors under optimal and predictable conditions. In the mobile environment contrast ratio takes on critical importance, as the lighting in vehicle and outdoor environments is not the typical "subdued" office lighting. In an outdoor setting, the light source can come from many angles and be very bright and highly reflective. In this environment "daylight readability" based on Department of Defense Standard DOD-STD-3009 "Lighting, Aircraft, Night Vision Imaging (NVIS) Compatible" is more appropriate, and DynaVue display meets or exceeds this standard.

Military Standard for Contrast Ratio

DOD-STD-3009 provides the military with acceptable standards for the development of the primary flight displays and mission avionics controls and displays subsystem for aircraft, and since the cockpit environment has similar lighting conditions encountered by outdoor workers, it is the ideal standard for mobile computers.

This DOD standard provides a realistic and easy to replicate method of measurement to determine critical factors such as display reflectance and contrast ratio. The measured display performance references have been shown to correlate closely with perceived qualities. A contrast ratio of >3.0:1 is specified as the minimum acceptable level under high ambient illumination (sunlight) conditions. A display with high ambient contrast ratio above 3.0:1 is considered optimal for outdoor viewability.

Deployed mobile workers require a display technology that provides optimum viewability in all lighting conditions. Rather than choosing a notebook display based on NITS alone, a high ambient contrast ratio must be taken into account in the selection process.

DynaVue® Display Technology - A Breed Apart

One such display technology is DynaVue® Technology; which creates optimum outdoor viewability by dramatically reducing both specular and diffused reflections. DynaVue technology uses polarizing techniques and multi-layer indexed matched coatings to transform the frequency of the reflected light waves and eliminate reflections that make displays unreadable. With DynaVue patent-pending display technology, customers experience rich luminous colors; dark areas appear darker and fine details are more pronounced. And since DynaVue does not require additional brightness, battery life and processor performance are optimized. DynaVue is an advanced design approach that:

- *Increases outdoor contrast ratio to provide rich color and improve visibility of fine details in all lighting.*
- *Provides better outdoor viewability than 1,000 nit solutions*
- *Provides dynamic color saturation for rich looking images.*
- *In most cases, uses lower power backlighting solutions to provide optimum brightness without sacrificing battery life or processor performance.*
- *Has the same optimal performance on or off dock.*
- *Provides better long term performance over the life-cycle of the product (typically 3-5 years).*

DynaVue is the only touchscreen display that follows DOD-STD-3009 guidelines by providing optimal viewability in all lighting conditions without sacrificing battery life or processing performance. It is the ideal solution for any field deployed application. Look for DynaVue touchscreen displays on all General Dynamics Itronix products.