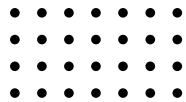




WinMATE



WHITEPAPER

HOW NVIS DISPLAYS BRIDGE THE GAP BETWEEN TECHNOLOGY AND REAL WORLD APPLICATION

The Technology behind the Night Vision Imaging System (NVIS)

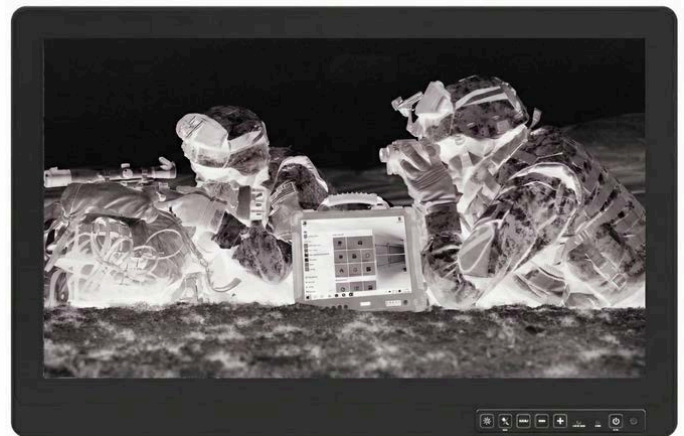
Winmate – Your Best-Mate in Rugged Solutions

WHY NVIS MATTERS

Night-time missions rely on a combination of night-vision goggles (NVG) and digital displays to provide situational awareness, navigation cues, and system status information. However, conventional displays are not designed for use alongside NVG. They can produce bright points, distorted colors, or unwanted reflections that interfere with the operator's visual adaptation in low-light conditions. Even small deviations in brightness or spectrum can disrupt night-vision clarity and degrade mission performance.

To prevent these issues, the U.S. Department of Defense established MIL-STD-3009, the foundational standard governing displays intended for simultaneous use with NVG. The standard defines how a display must control its brightness, color, and spectral output so that NVG and digital interfaces can operate safely together.

Among the classifications defined in MIL-STD-3009, Type I Class B is the specification most commonly applied to ground vehicles, tactical control systems, and soldier-borne devices. It provides strict requirements for luminance, spectral emissions, and chromaticity, ensuring that displays remain clear, readable, and non-disruptive during night operations.



WHAT MIL-STD-3009 REGULATES

MIL-STD-3009 outlines the technical boundaries that ensure a display can be safely used with night-vision equipment. Although the standard contains detailed measurement procedures, its requirements can be summarized across three fundamental domains:

1. Luminance Control

Displays must operate within a defined low-brightness range appropriate for night environments. Excessive luminance can create distracting bright points, reduce night-adapted vision, or interfere with NVG imaging. The standard specifies maximum allowable luminance for NVIS modes and mandates smooth, uniform dimming across the panel.

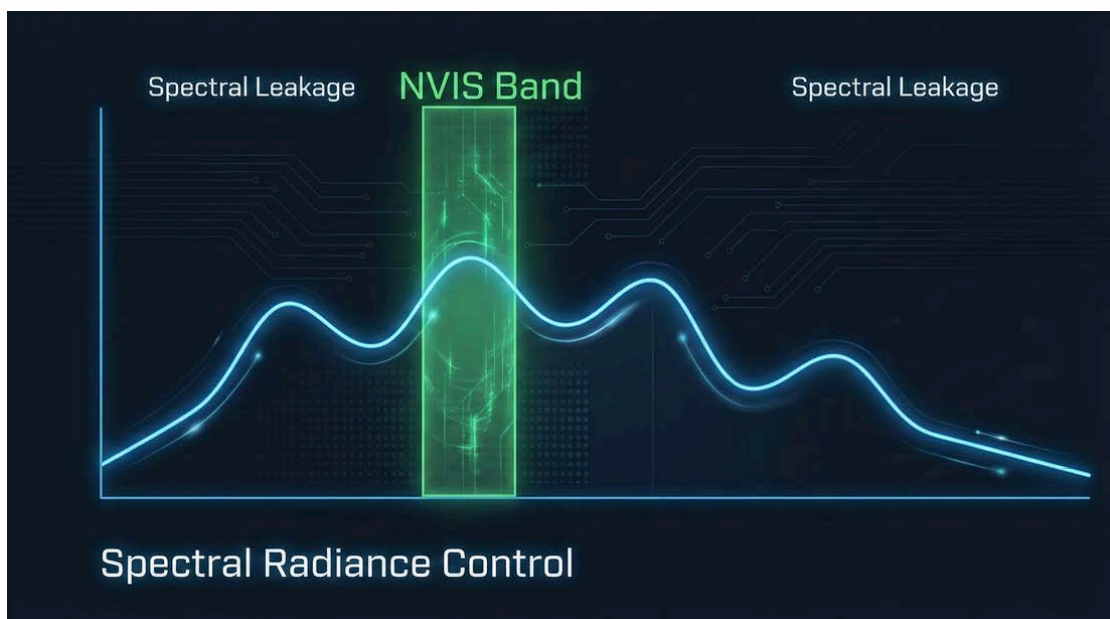
2. Chromaticity Requirements

To maintain symbol clarity and prevent misinterpretation, the standard restricts display colors to specific chromaticity regions. Colors that fall outside these regions may appear distorted or ambiguous through NVG. MIL-STD-3009 provides chromaticity “boxes” that define acceptable color boundaries for NVIS-compatible symbols.

3. Spectral Radiance Limits

The wavelength composition of the display’s light output must remain within an allowable NVIS band. Emissions outside this range—often called “spectral leakage”—can introduce glare, interfere with NVG sensitivity, or compromise operational concealment. MIL-STD-3009 defines strict radiance thresholds to prevent such leakage.

These three regulatory domains establish the foundation for all NVIS-compatible displays. Type I Class B builds on these principles and translates them into precise operational requirements.



WHAT TYPE I CLASS B MEANS

Type I Class B is the operational category of MIL-STD-3009 most widely adopted for ground vehicles, field command systems, and soldier equipment. It takes the general regulatory principles described in the standard and translates them into specific technical limits that displays must meet.

1. Strict Low-Luminance Requirements

Type I Class B defines narrow luminance limits appropriate for both vehicle interiors and field environments. These limits ensure that display elements remain visible without producing bright points that disrupt dark-adapted vision or interfere with NVG imagery.

2. Restricted Chromaticity Range (Type I Box)

This category mandates that displayed colors fall within designated chromaticity boundaries suitable for NVG interpretation. Only colors that remain stable and clearly distinguishable under NVG conditions are permitted. This prevents symbol distortion, inversion, or loss of definition.

3. NVIS-Band Spectral Compliance

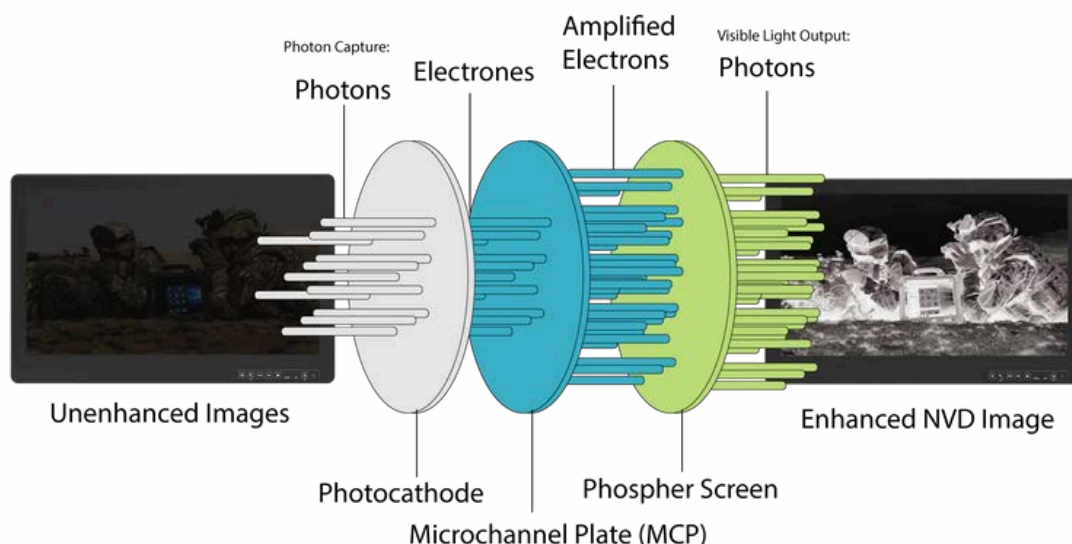
Type I Class B requires that nearly all emitted light energy remain within the approved NVIS spectral band. This minimizes spectral leakage, reduces visual interference, and ensures compatibility with night-vision sensors. Compliance with this requirement is essential for operational safety and visual consistency.

4. Aligns with Field Applications

Because of these controls, Type I Class B is the preferred category for:

- Tactical ground vehicles
- Field command consoles
- Handheld soldier devices
- Portable mission terminals

Its balance of visibility, safety, and spectral discipline makes it suitable for a wide range of nighttime mission profiles.



WINMATE NVIS DISPLAY KEY FEATURES

Winmate's NVIS displays are engineered to align with the requirements defined in MIL-STD-3009 and to operate reliably within the Type I Class B category. The following design features enable consistent night-vision performance across diverse mission environments:

1. NVIS-Compliant Backlight Architecture

Winmate employs narrow-band light sources and filtering techniques to shape the spectral output of the display. This ensures that emissions conform to the NVIS band and remain within acceptable radiance limits.

2. Precision Low-Luminance Adjustment

The display hardware supports fine-step dimming control, providing smooth transitions into low-light modes while preventing bright-pixel artifacts. This helps maintain symbol readability without compromising NVG compatibility.

3. Chromaticity Calibration to Type I Standards

Every NVIS display undergoes chromaticity measurement and calibration to confirm that all rendered colors fall within the MIL-STD-3009 Type I box. This ensures clarity and consistency across operational conditions.

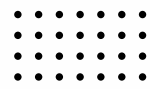
4. Environmental Stability and Repeatability

Winmate validates luminance, chromaticity, and spectral characteristics under temperature shifts, vibration exposure, and long-term operation. This minimizes drift and preserves compliance throughout the display's life cycle.

5. Mission-Ready Integration

Mechanical, electrical, and optical design elements are optimized for ground vehicles, control consoles, and soldier systems. This enables seamless integration into mission platforms requiring Type I Class B compatibility.





WINMATE DEFENSE DISPLAY

NVIS DISPLAY

8.4"



R08L100-VMN1-NI

G-WIN Resistive Touch Series

10.4"



R10L100-VMN1-NI

G-WIN Resistive Touch Series

15"



R15L100-67N1-NI

G-WIN IP67 Series

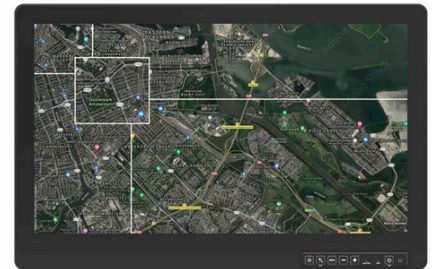
19"



R19L100-67N1-NI

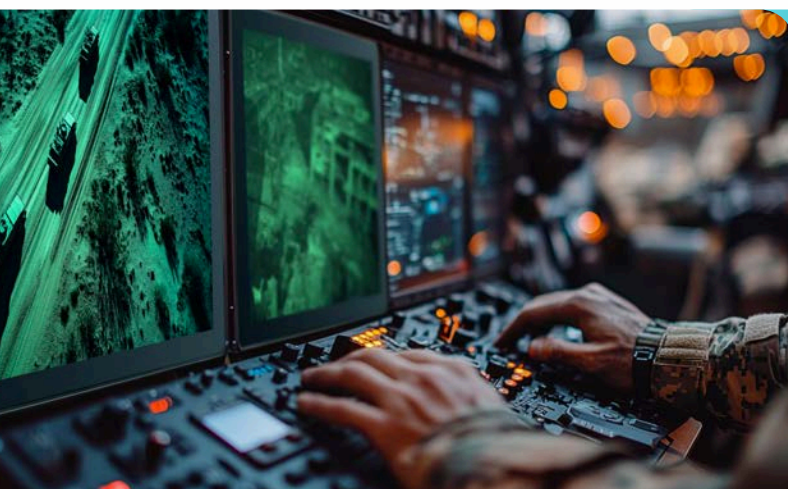
G-WIN IP67 Series

21.5"



W22L100-67N1-NI

G-WIN IP67 Series



DID YOU KNOW?

Winmate's NVIS-compatible displays are engineered to meet the MIL-STD-3009 standard, ensuring compatibility with night vision goggles (NVGs). With sizes ranging from 8.4" to 21.5", these rugged displays feature advanced filtering technology, dual-mode brightness control (day and NVIS modes), and IP-rated durability.



About Us

With over 30 years of industry experience, Winmate is a global leader in rugged computing and intelligent edge solutions. From rugged tablets and rugged laptops to panel PCs, industrial displays, Edge AI systems, and robotic controllers, our products are built to support demanding environments across industries. We specialize in providing tailored solutions and hardware customizations to meet the unique needs of customers in sectors such as industrial automation, defense, logistics, automotive, and more. Backed by in-house testing laboratories and a strong global distribution network, Winmate ensures reliable performance, long-term support, and proven durability.

For more information about Winmate, please visit our website: www.winmate.com

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