



Eye Safety of Diode Emitters

Since 1993, the International Electrotechnical Committee (IEC) and the European Committee for Electrotechnical Standardization (CENELEC, officially recognized as the European Standards Organization in its field by the Commission in Directive 83/189/EEC) have included Diode Emitters¹⁾ such as IREDS²⁾ and LEDs³⁾ in the laser safety standard. LEDs and lasers are technologically similar. However, the different radiance of LEDs compared to lasers was not taken into account. This resulted in LEDs being incorrectly assessed concerning eye safety. In the 1997 edition of the standard EN 60825-1 (and the IEC equivalent IEC 60825-1) the basic assessment errors were corrected.

The standard was further revised in January 2001. Amendment 2 was added (IEC60825-1 Amd. 2 Ed. 1.0) and is available at www.iec.ch. Based on the parallel voting process, this standard is also effective as a CENELEC document, EN60825-1 Amendment 2. Amendment 2 allows for a large increase in exposure limits, especially for the extended sources such as conventional LEDs and IREDS. The standard describes the Maximum Possible Exposure (MPE) and the Accessible Emission Levels (AEL) for the human eye and skin. The safe emission level is dependent on exposure time, wavelength, virtual source size and other parameters. For extended sources like LEDs, the apparent or virtual source size is the most important parameter in assessing risk and shall be specified in the component manufacturer's data sheet. Given the revised exposure limits, under normal operating conditions the MPE and AEL values are difficult to exceed when using conventional LEDs. Also, recognizing the low risk emissions of these sources, Amendment 2 eliminated the single fault condition for standard LEDs.

Recent studies in the United States support these revisions; finding that eye damage can not be caused by even the brightest of currently available LEDs.

Worldwide, no eye damage by LEDs has ever been reported. Diode Emitters efficiency is still increasing. Especially at the shorter wavelengths, a risk due to blue light effects, called blue light hazard, may occur and shall be considered.

By definition, Laser Class 1 devices are safe under all reasonably foreseeable conditions.

All of Vishay's IrDA transceivers and LEDs are rated as Class 1 devices when operated within specifications. The datasheet of each transceiver notes this Class 1 rating. The following example justifies the Class 1 rating. Given an LED transmitter emitting at 880 nm with a source size of 2 mm, the Class 1 limit for continuous operation is approximately 570 mW/sr. For an IrDA application using an FIR transceiver with a 25 % duty cycle, this limit would allow the LED to emit pulse intensities up to 2280 mW/sr. When operated within specifications, this high intensity will never occur. First, the IrDA[®] Physical Layer limits emitter intensities to 500 mW/sr. Second, IrDA transceivers limit the pulse duration. Finally, if drive conditions are set outside the specification, the thermal saturation of the emitter will limit the output intensity.

Vishay's LEDs and IrDA transceivers are eye-safe.

For more information regarding LEDs see the ICNIRP (International Commission on Non-Ionizing Radiation Protection) statement "ICNIRP Statement on Light-Emitting diodes (LEDs) and Laser Diodes: Implications for Hazard Assessment"⁴⁾.

In the United States the safety standard IEC60825-1, Amd. 2 is harmonized by the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH): "Laser Products - Conformance with IEC60825-1, Am. 2 and IEC60601-2-22; Final Guidance for Industry and FDA (Laser Notice No. 50)⁵⁾", issued July 26, 2001.

¹⁾ Diode Emitters: Semiconductor devices with diode characteristic emitting radiation such as LDs(laser diodes), IREDS or LEDs

²⁾ IRED: Infrared Emitting Diode. It is common but not correct to use the term LED also for Infrared Emitting Diodes

³⁾ LED: Light Emitting Diode, this term is used also for IR emitting diodes

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⁵⁾ Copies are available from the Internet at: <http://www.fda.gov/cdrh/comp/guidance/1346.html>