



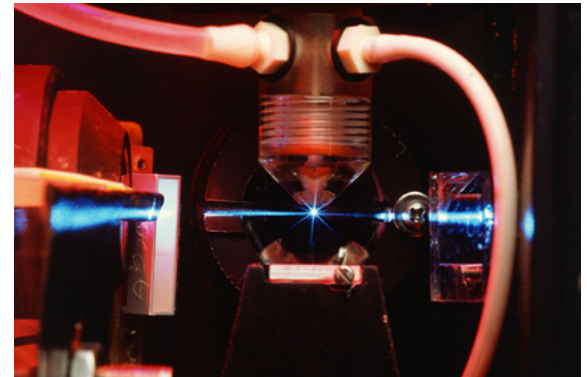
Lasers are very powerful tools that are useful in many different industries. If used improperly, they have the potential to damage human eyesight. However, if the proper precautions are taken, the risk of damage can be drastically reduced. This guide will provide a brief introduction to eye safety, and what you can do to ensure you are taking the proper precautions to minimize risk.

What is NOHD?

NOHD is short for Nominal Ocular Hazard Distance. Laser safety experts recommend not having direct naked eye exposure to a laser's beam closer than the rated NOHD for that laser. Lasers are extremely dense forms of light (irradiance). The permissible exposure limit is 2.54 milliwatts per square centimeter. If a person is outside the NOHD, the beam is considered completely eye safe since the irradiance falls below the hazard distance.

However, this does not mean that exposure within the NOHD is actually dangerous and will cause an eye injury, or even that it is probable to cause an injury. The NOHD is a nominal hazard distance, not an actual hazard distance.

It turns out that at 31.6% of the NOHD there is a 50/50 chance that an exposure will cause a minimally detectable change to the retina. We call this the ED50 (Exposure Dose 50%) distance.



Summary of Formula:

NOHD determination for unaided viewing; no atmospheric transmission condition considered. (Also known as the range equation– ANSI Std. 136.1-2000 Appendix)

$$R_{\text{NOHD}} = \theta^{-1} [(4Q_p / \pi \text{MPE}) - (d_{\text{out}})^2]^{0.5} \text{cm}$$

Where:

R_{NOHD} is the Nominal Ocular Hazard Distance, in centimeters.

θ is the beam divergence, in radians.

Q_p is the laser output radiant energy, in joules.

MPE is the appropriate per pulse Maximum Permissible Exposure, in joules/cm².

d_{out} is the output beam diameter of the laser, in centimeters.

Source: <http://prod.sandia.gov/techlib/access-control.cgi/2002/021315.pdf>



Ascendent ZLID NOHD (Nominal Optical Hazard Distance) Parameters

This chart provides laser specifications for the lasers equipped on Ascendent's Sigma series. For additional questions on any specification, or its associated value, please contact Ascendent (info@ascendentgroup.com).

Model	Wave length	Power (W)	Illumination Angle	Max NOHD Distance
SIGMA-750M	810nm (+/-5)	5	1.5~19.5°	25m
SIGMA-1500M	810nm (+/-5)	6.2	1 ~19.5°	36m
SIGMA-2000M	810nm (+/-5)	8.4	0.75~19.5°	60m
SIGMA-2500M	810nm (+/-5)	10.1	0.5~19.5°	92m
SIGMA-3500M	810nm (+/-5)	15	0.32~19.5°	185m
SIGMA-4000M	810nm (+/-5)	20	0.22~19.5°	289m
SIGMA-5500M	810nm (+/-5)	31	0.2~19.5°	355m

Please note the ranges in the charts are when laser is at max power and minimum divergence. Also the ZLID laser is only activated at night; during the day no laser is active and it is completely eye safe. Ascendent can custom build cameras to suit any eye safety requirements you may have.

Nominal Hazard Zone

The Nominal Hazard Zone (NHZ) is the distance within which the laser beam emits radiation at levels in excess of Maximum Permissible Exposure (MPE). Through site selection, beam obstruction, signage, and operational procedures each installation can ensure a completely safe site with zero risk during normal operation.

Hazard Information

Ascendent Sigma ZLID units have a Class 3 B laser however, with proper site installation and a creation of a "virtual protective zone", it can achieve a class 1 installation, ensuring that no person can enter the NHZ during operation of a camera. This "virtual protective zone" is achieved by installing the Sigma camera higher above ground level increasing the angle and distance from which the laser is operating. If the Sigma camera is properly installed laser exposure risks are eliminated and completely safe during normal operation.

Even with proper installation, all users should carefully read and follow the procedures in the Sigma user manual and ensure that the site layout is not changed, such as:

- Unauthorized entry or removal of access panels, doors or protective barriers (while laser is activated)
- Failure to adhere to applicable safety warning and precautions (if someone is within the NOHD they must wear eye safety glasses)
- Unauthorized access to the Sigma during operation (while the laser is active)