Bird Control Group

Laser awareness guide

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LASER	
class	3B
power	Output power in mW (varies per product)
wavelength	520 - 532 nm (green continuous wave)
divergence	0.05 mrad
diameter at aperture	40 - 50 mm
lifetime	> 5,000 hours
NOHD	Distance in meters (varies per product)
MPE	25.4 W/m^2

This guide is provided to give you more insight in the properties of your laser device.

This document explains each of the technical specifications of the product, as found in the user manual, with respect to safety.

Technical specifications: Laser

LASER	
class	3B
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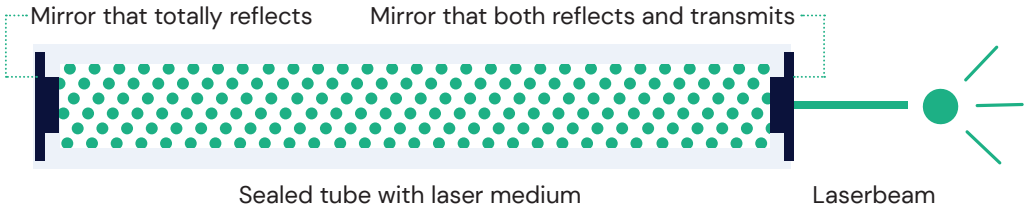
LASER is an abbreviation of Light Amplification by the Stimulated Emission of Radiation. A basic type of laser consists of a sealed tube, containing a pair of mirrors, and a laser medium. When energy is applied to the laser medium, it becomes empowered and releases energy as particles of light (photons).

A pair of mirrors at both ends of the sealed tube either reflects or transmits the light (see illustration below) in the form of a concentrated stream of light photons, all flowing in the same direction. The photon stream leaving the tube at the aperture side is called a laser beam.



Technical specifications: Class

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Lasers are used for a variety of purposes including pointing out objects during a presentation, aligning materials at construction sites, and by doctors for cosmetic and surgical operations.

Class 1	CD/DVD Player/Recorder, Laptop or Personal Computer
Class 2	Presentation Laser Pointer, Barcode Reader
Class 3R	Some Measuring & Targeting Devices, Higher Power Pointers
Class 3B	Higher power laser products intended for professional applications
Class 4	Medical Lasers, Industrial Cutting/Welding, Scientific Applications

Technical specifications: Laser class

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Laser classification is based on the laser's potential for causing injury to the eye or skin from direct exposure to the beam or by exposure to reflections of the beam via reflective surfaces or objects.

The table below shows the relation between laser classes and the potential of the laser beam to cause damage.

Laser Hazard Classification	
Class 1	Low power; considered safe
Class 2	Eye protection afforded by the eye blink reflex
Class 3	Medium power; hazard to the eye from direct exposure
Class 4	High power; hazard to the eye and skin + fire hazard

Technical specifications: Laser class

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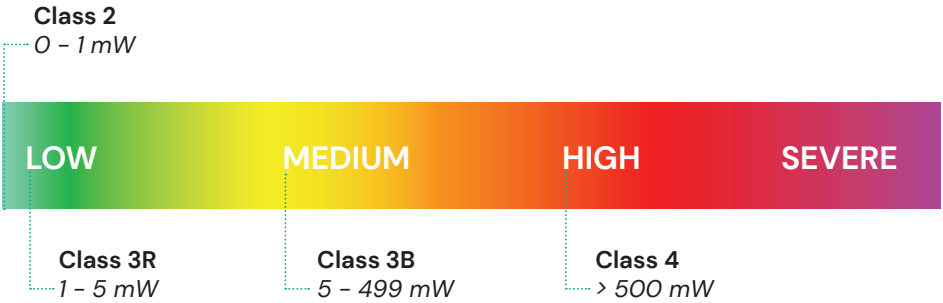
Each laser beam is assigned to one of the four laser classes (1,2,3 or 4). The laser class depends on the amount of energy transported within the laser beam (laser power) and the wavelength (color) of the laser beam. The output power for a class 3B laser lies between 5 and 499 mW (milliWatts).

The table below shows the relation between laser classes and the potential of the laser beam to cause damage.



Technical specifications: Wavelength

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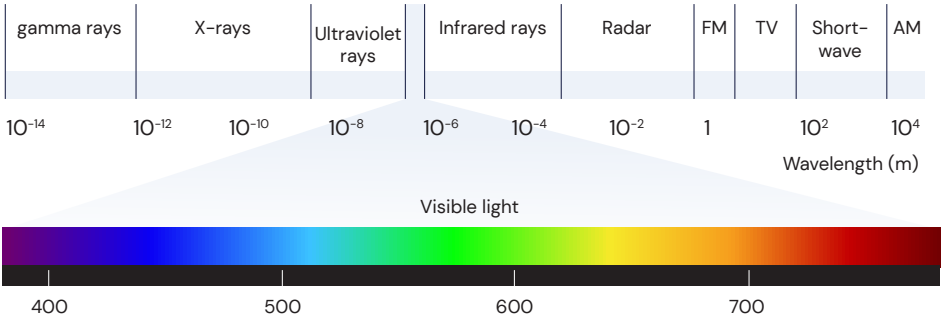
Bird Control Group's products emit laser light with a wavelength of between 520 and 532 nm (nanometer), which is most visible to the bird's eye. Light within the visible and near infrared spectrum 400 - 1400 nm (the so-called "retinal hazard region") can cause damage to the retina. Direct exposure to laser light within this spectrum should be avoided. Wavelengths outside this region should always be avoided, (i.e., ultraviolet and far infrared spectrum) nevertheless they are absorbed by proprietary coatings on the lenses of all optics.



Technical specifications: Divergence

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To prevent unintended exposure to the laser beam, the use of laser safety glasses is recommended for people present in the laser projection area. Laser safety glasses should be selected to protect against the laser's specific power and wavelength.

Technical specifications: Divergence

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Laser optics are very precise, which results in a very constant beam width with optimal bird repelling capabilities over long distances.

A negative side effect of the extremely low beam spread is that even at a long distance from the source, the laser beam poses a risk for glare, distraction or even eye injuries (if direct exposure is maintained long enough).

Technical specifications: Laser diameter

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Bird Control Group's products are equipped with a beam expander, this helps to avoid potential eye injuries. A specially designed optical system turns the original narrow beam into a much wider beam. As a result, only a small part of the complete beam can enter the eye, as the cross-section of the beam is much larger than the opening of the iris.

A narrow beam compared to the expanded beam from the same laser source. (the laser power is spread across a larger surface)

⚠ *Do not use optical instruments to view the laser beam (e.g. binoculars).*

Technical specifications: Laser lifetime

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The lifetime of the laser medium is a mean value of the period this laser medium can project laser light.

The quality of the laser medium decreases over time, there for making the laser lifetime finite to around 5000 hours.

Technical specifications: NOHD

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The Nominal Ocular Hazard Distance (NOHD) is the distance from the laser source from which the laser beam becomes safe to be exposed to (i.e. at distances above the NOHD the intensity of the energy per surface becomes lower than the Maximum Permissible Exposure on the cornea of the eye).
At a distance that is shorter than the NOHD, the laser beam is a potential hazard and could cause damage to the eye.
NOHD values are calculated based on worst-case conditions.

Technical specifications: MPE

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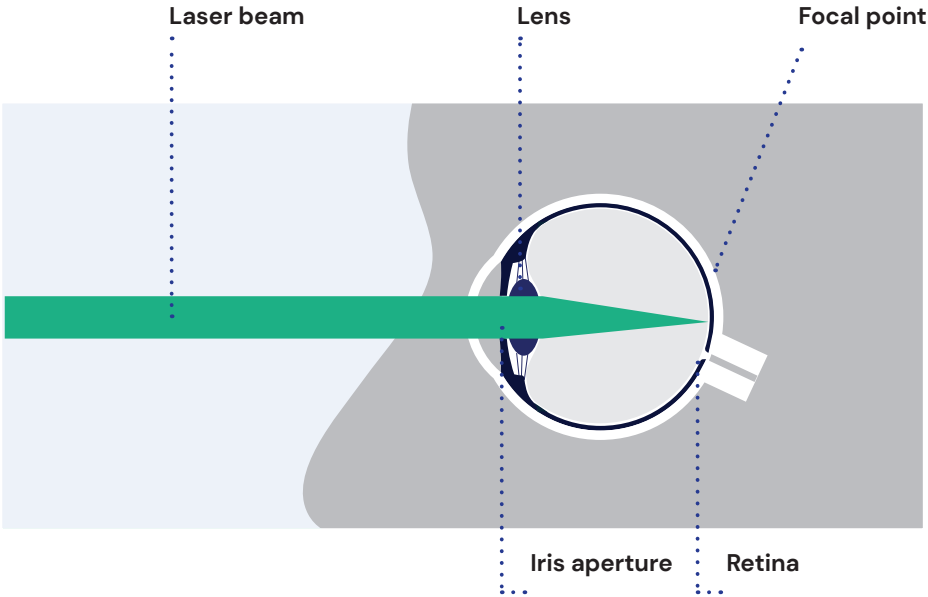
The Maximum Permissible Exposure (MPE) is the highest power or energy density (in W/cm2 or J/cm2) of a laser source that is considered safe, i.e. that has a negligible probability for creating damage. It is usually obtained by taking 10% of the dose that has a 50% chance of creating damage under worst-case conditions.

The MPE is measured at the cornea of the human eye or at the skin, for a given wavelength and exposure time, which is mostly set to 0.25 seconds, because this is the blink reflex time.

Understanding eye hazard:
Staring into the beam (direct exposure)

Eye injury occurs when laser light stays in one spot on the retina long enough for heat to build up to injurious levels. In other words: When eye injury occurs, the value for maximum permissible exposure (MPE) has been exceeded.

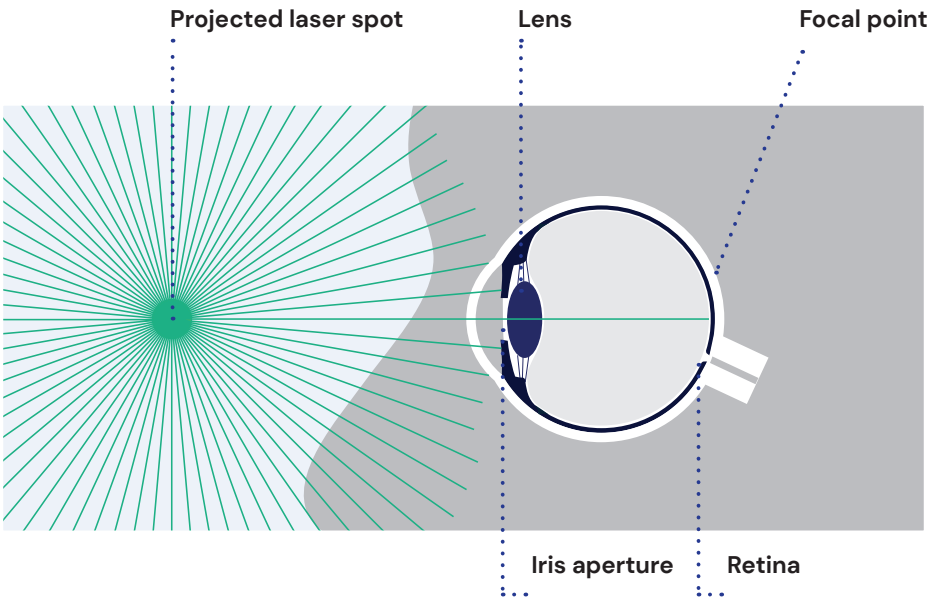
⚠ A person cannot turn away or blink fast enough in order to prevent retinal eye injury in cases where a 3B laser beam is directed to the eye.



Understanding eye hazard:
Looking at the projected spot (diffuse reflection)

The scattered light from the laser "spot" as viewed on a surface does not form an eye hazard under normal conditions. Staring to the reflected laser spot from a short distance (more photons entering the eye) or for an extended period of time may lead to eye hazard.

⚠ Avoid staring at the laser spot at close range, for more than a few seconds.



Understanding eye hazard:
Reducing risk

	Eye injury is a result of:	Safety system	How to reduce risk
1	**...The amount of photons (intensity of the beam)...**	A beam expander reduces the intensity of the beam.	Avoid the use of binoculars or other optical instruments which can concentrate the laser beam. Spectacles are not considered optical instruments.
2	**...that are entering through the iris aperture...**	The iris aperture is a natural system that prevents too much light from entering the eye.	Be extra careful when using lasers at night, since the human eye is more vulnerable for eye injury due to a larger iris aperture in dark light conditions.
3	**...focused continuously on one spot on the retina...**	The laser beam can be directed accurately.	Never stare into the beam. Never aim the laser beam towards people or vehicles.
4	**...for long enough to build up heat to injurious levels...**	When a laser beam is moving, the maximum exposure time is limited, thus reducing risk of injuries in case someone's eye is accidentally exposed.	Do not block the free movement of the laser device.

Hazard distances

Result of exposure to laser beam	Distance worst case scenario *Deliberately staring into a steady beam without eye protection.*	Distance during normal operation *Unintentional exposure to a moving beam with a minimum rotation speed of 1.25 °/sec.*
⚠ **Laser can cause permanent eye injuries.**	Distance < NOHD value	**Distance < 480 meter** *Beyond this distance, the velocity of the laser spot is that quick, so that the laser can no longer cause hazardous damage to the eye. Exposure time is <0.005 sec. Value based on 250mW output power, iris aperture ø7 mm (night conditions).*
⚠ **Laser can cause temporarily flash blindness to a pilot or driver, causing afterimages**	Distance < ± 3 x NOHD value	
⚠ **Laser can cause glare, blocking a pilot or driver's vision**	Distance < ± 10 x NOHD value	
⚠ **Laser can cause distraction, being brighter than surrounding lights**	Distance < ± 20 x NOHD value	

The hazard distances as listed are intended only as general guidance.

Safety notice

This document is intended for the educational, instructional and informational purposes of the user and is not to be considered a substitute for a knowledgeable and trained Laser Safety Officer (LSO) with the duties and responsibilities as defined in the ANSI Z136 standard published by the American National Standard Institute.

When in doubt about local safety: Consult a Laser Safety Officer to assess your specific situation.

Read the user manual before using our products

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Published: 16 April 2024