Spot-On Laser Modules and Laser Diode Safety

INTRODUCTION

These devices have been designed as complete laser components for incorporation into customer equipment and although their output powers have been set in accordance with BS(EN)60825 they are not certified lasers as defined in the specification for a final product. When incorporated into a piece of equipment, it may be necessary for additional safety features to be added before the equipment fully complies with the standard. Final classification will be dependent on the way the laser is used within the product, including access to the laser component and beam. Any final commercial product that incorporates a laser must be certified in its own right, irrespective of whether the incorporated laser is certified or not by the manufacturer.

When incorporated into a final product as part of the process of CE marking, all laser and LED products sold in Europe must be certified to EN 60825-1. Manufacturers can self certify their equipment to EN 60825-1, however, many manufacturers prefer to have independent verification of their compliance with the classification requirements.

SAFETY

All laser devices produce beams of intense monochromatic light which can present potential biological hazards. Laser products are classified to take account of the amount of laser beam to which you can get access when the product is in normal use or during routine user maintenance. In most circumstances laser safety eyewear is required if there is a possibility of direct exposure or specular reflectance from a laser beam higher than Class 2 or 3R. A laser product may contain a laser of a higher class and this may be accessible during servicing. Labels on the product should provide guidance on the laser beam hazard. Full details about the classification scheme can be found in the current British Standard on Laser Safety, BS EN 60825-1, as amended or the international standard IEC60825-1 **'Safety of laser products Part 1: Equipment classification, requirements and user's guide'.** This is the fundamental laser safety document to which all other laser safety documents refer. It defines Maximum Permissible Exposures (MPEs), Accessible Emission limits (AELs), laser classes and measurement conditions, labelling, engineering controls etc.

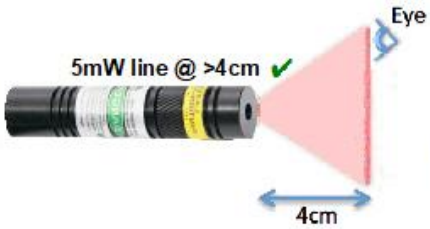
LASER CLASSES

Laser modules and diodes are supplied as OEM components (or unfinished products). The laser class will depend on the eventual application e.g. the power supply used, the housing, safety features etc.

While classified as OEM devices, laser modules conform to the wavelength and output power conditions of Class 2 /2M, Class 3R, Class 3B or Class 4 laser products as described in individual device information sheets. Warning labels are attached to each device. The requirements for labels are region specific and the correct labels must be fitted by the user for the region applicable before the equipment is put into operation. If information labels are hidden in the installed state, the user must ensure that additional labels are fitted at the point of installation.

LINE LASER POWER CONSIDERATIONS

For most visible lasers the maximum permissible exposure (MPE) is 1mW (Class 2 laser). If the laser is projecting a spot, all the laser output could reasonably enter the pupil of the eye.



For a line or cross laser at a distance, only a fraction of the light can enter the eye, eg the exposure from a 5mW 90° line laser at 4cm distance would be <1mW. (10mm pupil)
Thus, if a 5mW (Class 3R) laser is mounted in an enclosure or device so that it cannot be viewed at a distance of less than 4cm the maximum exposure would be normally be <1mW and the device would become Class 2M. (The "M" signifies that if the laser is viewed with an optical device such as a telescope the exposure would exceed Class 2)

Laser Type	Minimum Distance for <1mW MPE* (Class 2M)
1mW line laser	no minimum distance
5mW 90° line laser	3cm
50mW 90° line laser	30cm (~3R at 6cm)
100mW 90° line laser	60cm (~3R at 12cm)

- It is never recommended to directly look at a laser source, treat values as possible accidental exposure values.
- Class 3R lasers have a maximum exposure value of 5mW visible light

LASER CLASS SUMMARY

ANSI and IEC laser classification	Class 1		Class 2		Class 3		Class 4	Notes
Sub-class	**Class 1**	**Class 1M**	**Class 2**	**Class 2M**	**Class 3R**	**Class 3B**	**Class 4**	
U.S. FDA laser classification	Class I	No special FDA class	Class II	No special FDA class	Class IIIa (definition is different but results are similar)	Class IIIb	Class IV	Newer ANSI/IEC number classes are now preferred over older FDA Roman numeral classes
Human-accessible laser power (for visible light)	For visible light, emits beam less than 0.39 milliwatts, or beam of any power is inside device and is not accessible during operation.		Emits visible beam of less than 1 milliwatt.		For visible light, emits beam between 1 and 4.99 milliwatts.	For visible light, emits beam between Class 3R limit (e.g. 5 milliwatts) and 499.9 milliwatts	For visible light, emits beam of 500 milliwatts (1/2 Watt) or more	Non-visible lasers emitting infrared or ultraviolet are not included in this chart. Only visible lasers are discussed.
Caution/warning indication	No special caution/ warning indication		No special caution/ warning indication		**CAUTION**	**WARNING**	**DANGER**	
Label descriptive text		DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS	DO NOT STARE INTO BEAM	DO NOT STARE INTO BEAM OR EXPOSE USERS OF TELESCOPIC OPTICS	AVOID DIRECT EYE EXPOSURE	AVOID EXPOSURE TO BEAM	AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION	For visible-light lasers, the word "light" can be used instead of "radiation". The latter is more accurate for lasers emitting infrared and ultraviolet radiation.
EYE AND SKIN HAZARDS								
Eye hazard for intraocular exposure (having a direct or reflected beam enter the eye)	Safe, even for long-term intentional viewing. For visible light, usually applies when the laser is enclosed inside a device (ex: CD or DVD player) with no human access to laser light.	Safe for unaided eye exposure. May be hazardous if viewed with optical instruments such as binoculars or eye loupe.	Safe for unintentional exposure less than 1/4 second. Do not stare into beam.	Safe for unintentional (< 1/4 sec) unaided eye exposure. May be hazardous if viewed with optical instruments such as binoculars or eye loupe.	Unintentional or accidental exposure to direct or reflected beam has a low risk. Avoid intentional exposure to direct or reflected beam.	Eye hazard; avoid exposure to direct or reflected beam.	Severe eye hazard; avoid exposure to direct or reflected beam.	
Maximum or typical Nominal Ocular Hazard Distance (for 1 milliradian beam, exposure time less than 1/4 second)	Not an eye hazard -- does not apply	Consult an LSO as described in the Technical Note below	**NOHD of 0.99 mW beam:** 23 ft (7 m)	Consult an LSO as described in the Technical Note below	**NOHD of 4.99 mW beam:** 52 ft (16 m)	**NOHD of 499.9 mW beam:** 520 ft (160 m)	**NOHD of 1000 mW (1 Watt) beam:** 733 ft (224 m). **NOHD of 10 W beam:** 2320 ft (710 m)	Avoid eye exposure to a direct or reflected laser beam, within the NOHD. The closer you are to the laser, the greater the chance of hazard and the more serious the injury potential.
Eye hazard for diffuse reflection exposure (looking at the laser "dot" scattered off a surface)	None	Consult an LSO	None	Consult an LSO	None	Generally safe. Avoid staring at the laser "dot" on a surface for many seconds at close range.	To avoid injury, do not stare at laser "dot" on a surface. The light is too bright if you see a sustained afterimage, lasting more than about 10 seconds.	
Skin burn hazard	None	Consult an LSO	None	Consult an LSO	None	Can heat skin if beam is held long enough on skin at close range	Can instantly burn skin. Avoid direct exposure to the beam.	
Materials burn hazard	None	Consult an LSO	None	Consult an LSO	None	Can burn materials if beam is held long enough on substance at close range	Can instantly burn materials. Avoid direct exposure to the beam, for materials susceptible to burning.	Dark materials which absorb heat, and lightweight materials such as paper and fabric, are most easily burned by visible laser light.
VISUAL INTERFERENCE DISTANCES								
Maximum or typical flashblindness distance (FAA 100 μW/cm², for 1 milliradian beam, 555 nm green light)	Not applicable; beam is usually contained inside a device such as a CD or DVD player	Consult an LSO	**For a 0.99 mW beam:** 117 ft 36 m	Consult an LSO	**For a 4.99 mW beam:** 261 ft 80 m	**For a 499 mW beam:** 2,614 ft (1/2 mile) 797 m (0.8 km)	**For a 1 Watt beam:** 3,696 ft (0.7 mile) 1,127 m (1.1 km) **For a 10 W beam:** 11,689 ft (2.2 miles) 3,563 m (3.5 km)	Value given is for 555 nm, the green wavelength that appears brightest to the light-adapted human eye. This gives the longest hazard distance. To approximate for red laser light, divide the distance by about 5; for blue, divide by 20.
Maximum or typical glare distance (FAA 5 μW/cm², for 1 milliradian beam, 555 nm green light)	See above	Consult an LSO	523 ft 159 m	Consult an LSO	1,169 ft 356 m	11,689 ft (2.2 miles) 3,563 m (3.5 km)	**For a 1 Watt beam:** 16,531 ft (3.1 miles) 5,039 m (5 km) **For a 10 W beam:** 52,275 ft (9.9 miles) 15,933 m (16 km)	See above
Maximum or typical distraction distance (FAA 0.05 μW/cm² or 50 nanowatts/cm², for 1 milliradian beam, 555 nm green light)	See above	Consult an LSO	5,227 ft (1 mile) 1,593 m (1.6 km)	Consult an LSO	11,689 ft (2.2 miles) 3,563 m (3.5 km)	116,890 ft (22 miles) 35,628 m (35.6 km)	**For a 1 Watt beam:** 165,307 ft (31 miles) 50,386 m (50 km) **For a 10 W beam:** 522,746 ft (99 miles) 159,333 m (160 km)	See above
Technical Notes	For a 1/4 second exposure to accessible visible-light beams, Class 1 limits are the same as Class 2, and such lasers are usually labeled as Class 2.	We are unaware of any Class 1M laser devices intended for consumer use. If you do have such a laser, consult a qualified Laser Safety Officer for more detailed analysis.	Class 2 (and 2M) only applies to visible lasers. Infrared and ultraviolet lasers cannot be Class 2 (or 2M).	We are unaware of any Class 2M laser devices intended for consumer use. If you do have such a laser, consult a qualified Laser Safety Officer for more detailed analysis.	Class 3R is either: (1) From 1 to 4.99 mW into a 7mm aperture (e.g., pupil of the eye) or (2) five times the Class 2 limit of 2.5 mW/cm², which works out to be 12.5 mW/cm². The second method is used by LaserSafetyFacts to determine NOHD.			
	Class 1	**Class 1M**	**Class 2**	**Class 2M**	**Class 3R**	**Class 3B**	**Class 4**	
	Class 1		**Class 2**		**Class 3**		**Class 4**	

Class 2 (II) laser safety information

WHAT IS A CLASS 2 LASER?
Class 2 lasers are considered safe for normal operation. Class 2 lasers' output power is below 1 milliwatt. All Class 2 lasers emit visible light only.

In Australia, the U.K., and many other countries, only Class 2 lasers can be sold as "pointers" or for pointing purposes. (In the U.S., pointers can also be Class 3R.)

Class 2 is the same as the Roman numeral "Class II" you may see on some lasers' labels. On this website, we primarily use the Arabic numerals, for convenience.

SAFE USE GUIDANCE – GENERAL
A Class 2 laser is relatively weak. It normally would not harm an eye unless a person deliberately stared into the beam. Laser protective eyewear is normally not necessary. A Class 2 laser is not a skin or materials burn hazard.

However, even a Class 2 laser can be a distraction, glare or flashblindness hazard for pilots and drivers. NEVER aim any laser towards an aircraft or vehicle that is in motion. This is unsafe and is illegal -- you could be arrested and jailed.

Class 3R (IIIa) laser safety information

WHAT IS A CLASS 3R LASER?
Class 3R lasers are considered safe when handled carefully. There is only a small hazard potential for accidental exposure. For visible-light lasers, Class 3R lasers' output power is between 1 and 4.99 milliwatts.

In the United States, both Class 2 and 3R lasers can be sold as "pointers" or for pointing purposes. (In Australia, the U.K., and many other countries, laser pointers are restricted to Class 2 only.)

Class 3R is essentially the same as the Roman numeral "Class IIIa" you may see on some lasers' labels.

SAFE USE GUIDANCE – GENERAL
A Class 3R laser is low powered. It normally would not harm eyes during a momentary exposure of less than ¼ second. This is within the aversion response, where a person turns away and/or blinks to avoid bright light.

Do not deliberately look or stare into the laser beam. Laser protective eyewear is normally not necessary. A Class 3R laser is not a skin or materials burn hazard.

However, a Class 3R laser can be a distraction, glare or flashblindness hazard for pilots and drivers. **NEVER aim any laser towards an aircraft or vehicle that is in motion.** This is unsafe and is illegal -- you could be arrested and jailed.

Class 3B (IIIb) laser safety information

WHAT IS A CLASS 3B LASER?
Class 3B lasers are hazardous for eye exposure. They can heat skin and materials but are not considered a burn hazard. For visible-light lasers, Class 3B lasers' output power is between 5 and 499 milliwatts.

Class 3B is the same as the Roman numeral "Class IIIb" you may see on some lasers' labels.

SAFE USE GUIDANCE – GENERAL
Class 3B visible-beam lasers are medium powered, from 5 to 499 milliwatts. **A Class 3B laser can cause eye injury.** The more powerful the laser, the greater the chance of injury.

Use of laser protective eyewear is suggested or recommended (depending on the laser's power level), as discussed elsewhere on this page.

A Class 3B laser can be a distraction, glare or flashblindness hazard for pilots and drivers. **NEVER aim any laser towards an aircraft or vehicle that is in motion.** This is unsafe and is illegal -- you could be arrested and jailed.

Always be aware of the beam location. Keep it away from people's eyes and heads. Watch out for reflected beams from glass and shiny surfaces. When outdoors, you must avoid aiming at or near aircraft.

Class 4 (IV) laser safety information

Class 4 lasers are hazardous for eye exposure. They also can burn skin and materials, especially dark and/or lightweight materials at close range. They should be used with extreme care.
For visible-light lasers, Class 4 lasers' have an output power 500 milliwatts and above.
Class 4 lasers modules are not included in the Spot-On range.

SAFE USE GUIDANCE – GENERAL
Class 4 lasers must always be used with laser protective eyewear and precautions are essential to ensure accidental exposure to the beam is not possible whether direct or reflected. Specific safety systems are required.

PREVENT EYE EXPOSURE
Class 4 visible-beam lasers are high-powered. A Class 4 laser can cause a significant eye injury if the beam, whether direct or reflected, enters the eye.
Even staring at the diffuse reflection of a laser "dot" on a wall or other surface, may cause an eye injury within a few feet of the dot. Do not stare at the laser "dot" when it is close to you. To prevent eye exposure, always be aware of the beam location. Keep it away from people's eyes and heads. Watch out for reflected beams from glass and shiny surfaces.

AVOID SKIN EXPOSURE
Avoid exposure to skin and sensitive materials. A Class 4 laser can burn skin and materials, especially dark and/or lightweight materials at close range.

WARRANTY
Laser Level Limited's exclusive warranty is that the products are free from defects in materials and workmanship when supplied by Laser Level Limited.
Laser Level Limited makes no warranty or representation, express or implied, regarding non-infringement, merchantability, or fitness for particular purpose of products. Any buyer or user acknowledges that the buyer or user alone determined that the products will suitably meet the requirements of their intended use. Laser Level Limited disclaims all other warranties, express or implied.

LIMITATIONS OF LIABILITY
Laser Level Limited shall not be responsible for special, indirect, or consequential damages, loss of profits, or commercial loss in any way connected with the products, whether such claim is based on contract, warranty, negligence, or strict liability.
In no event shall responsibility of Laser Level limited for any act exceed the individual price of the product on which liability is asserted.
In no event shall Laser Level Limited be responsible for warranty, repair, or other claims regarding the products unless Laser Level Limited's analysis confirms that the products were properly handled, stored, installed, and maintained and not subject to contamination, abuse, misuse, or inappropriate modification or repair.

SUITABILITY FOR USE
Laser Level Limited shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the product.
At the customer's request and expense, Laser Level Limited will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.
Never use the products for an application involving serious risk of life or property without ensuring that the system as a whole has been designed to address the risks, and that the Laser Limited product is properly rated and installed for the intended use within the overall equipment or system.

CHANGE IN SPECIFICATIONS
Product specifications and accessories may be changed at any time based on improvements and other reasons.
It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the product may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request.

DIMENSIONS AND WEIGHTS
Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ERRORS AND OMISSIONS
Information sheets have been carefully checked and are believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors or omissions.

PERFORMANCE DATA
Performance data is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Laser Level Limited test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the Laser Level Limited Warranty and Limitations of Liability.

GENERAL SUPPLY CONDITIONS
You are over 18 years of age. You understand that laser components are dangerous when not properly assembled into a finished product and that Laser Class will vary with application and modification. You understand that laser modules, diodes etc. are an OEM product and need to be properly incorporated into a finished product per your local regulations. You will use these lasers in a safe and responsible manner and for a legal purpose. You are legally responsible for the use of these laser components or laser containing items and also the improper use of these components or their end products. You are legally responsible for any injury to anybody resulting from the use of or assembly of these components or their finished products.

RETURNS and UNSUITABLE PRODUCTS
If you do not accept these conditions you should return your purchase for a refund.
If you are not satisfied with any product on arrival on you may return it for a refund.
If you have any concerns about being able to use our lasers safely after reading the instructions you may return the laser for a refund.

For further details see please see the current terms and conditions at www.laserlevelshop.co.uk