KENT PERISCOPES
WHITE PAPER

"I'm told that there are no Laser Weapons on the battlefield so why do I have to protect myself from Lasers ?"

Introduction

Whilst there continues to be ongoing research into the development of Laser Weapons, the current threat from Lasers on the battle field in fact comes from Laser Range Finders.

Whilst Laser Range Finders are not intentionally designed to cause bodily harm they can cause irreparable damage to the human eye.

Laser range-finders

A laser range-finder is a device which uses a laser beam in order to determine the distance to a reflective object. The most common form of laser range-finder operates on the time of flight principle by sending a laser pulse in a narrow beam towards the object and measuring the time taken by the pulse to be reflected off the target and returned to the sender.

Time of flight - this measures the time taken for a light pulse to travel to the target and back. With an accurate measurement of the time taken, since the speed of light is a given, the distance from the source to the target object can be calculated. Typically, in practice multiple pulses are fired sequentially and the average response time used.

A typical Military Laser Range Finder

Use of laser-range finders in conjunction with weapons sights

Most sophisticated weapon systems today have a laser-ranging capability built in. If not, as may be the case of a hand held high powered rifle, the sniper or gunner has at his disposal a ballistic graticule in his or her gun site.

A typical Graticule pattern

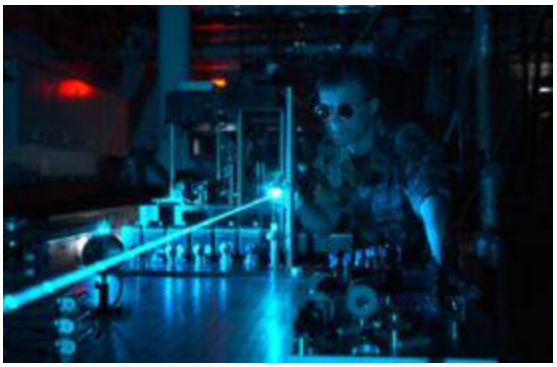
A well designed Graticule pattern enables you to accurately fire at a target once the correct aiming mark is "layed" on to the target, taking into account the ballistics of the particular calibre of the weapon used to avoid the need for any further calculations in respect of "trajectory" "round drift" "trunnion tilt" and "parallax" etc.

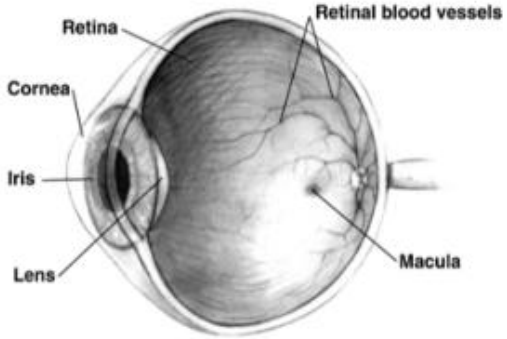
However, all of this will be ineffective if you do not select the correct range to the target on the Graticule Pattern. This is why a laser-range finder is used.

Risk to the human eye from lasers

A laser is a light source that can be dangerous to the people exposed to it. Even low power lasers can be hazardous to eyesight. A person exposed to laser radiation (especially invisible radiation) may be unaware that damage is occurring. Some lasers are so powerful that even the diffuse reflection from a surface can be hazardous to the eye. Laser radiation predominantly causes eye injury via thermal effects on the retina.

A transient increase of only 10°C can destroy retinal photoreceptors. The coherence, the low divergence angle of laser light and the focusing mechanism of the eye means that laser light can be concentrated into an extremely small spot on the retina.





If the laser is sufficiently powerful, permanent damage can occur within a fraction of a second, faster than the blink of an eye. Sufficiently powerful visible to near infrared laser radiation (400-1400nm) will penetrate the eyeball and may cause heating of the retina, whereas exposure to laser radiation with wavelengths less than 400nm and greater than 1400nm are largely absorbed by the cornea and lens, leading to the development of cataracts or burn injuries. The maximum intensity is when you are nearest to the laser light source. For that reason, you are more at risk from your own vehicles accidently directing a laser beam into the field of view of your own periscopes.

Infrared and ultraviolet lasers are particularly hazardous, since the body's protective "blink reflex" response only operates if the light is visible. For example, some people exposed to a high power Nd: YAG laser emitting invisible 1064 nm radiation, may not feel pain or notice immediate damage to their eye sight. A pop or click noise emanating from the eyeball may be the only indication that retinal damaged has occurred i.e. the retina was heated to over 100°C resulting in localized explosive boiling accompanied by the immediate creation of a permanent blind spot.

Laser protection in Kent Periscopes optical equipment

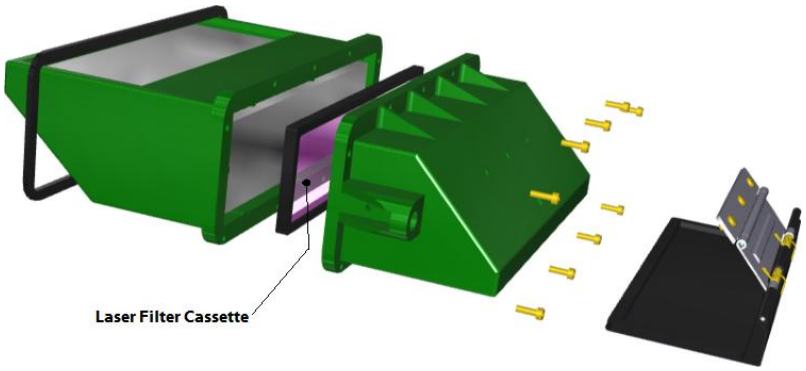
Kent Periscopes can provide protection for a range of laser threats for your gunner or commander.

To date we have supplied a large number of filters from ISUZU Glass Co. for either YAG 1064nm (1.064µm) or Ruby 694nm (0.694µm), and have produced a single combined filter that protects simultaneously against both wavelengths.

We can also supply filters to provide protection from a range of other laser wavelengths.

Upgradable protection over time

Kent Periscopes products are "future proofed" in terms of laser protection as the laser protection filter is housed in a separate ‘cassette’ sub-assembly.



All that is required to upgrade the filter is to uncouple the two halves of the periscope, change the filter, close-up, purge and re-desiccate. In the same manner, a laser protection cassette can be added retrospectively even where none was fitted when the equipment was originally assembled.

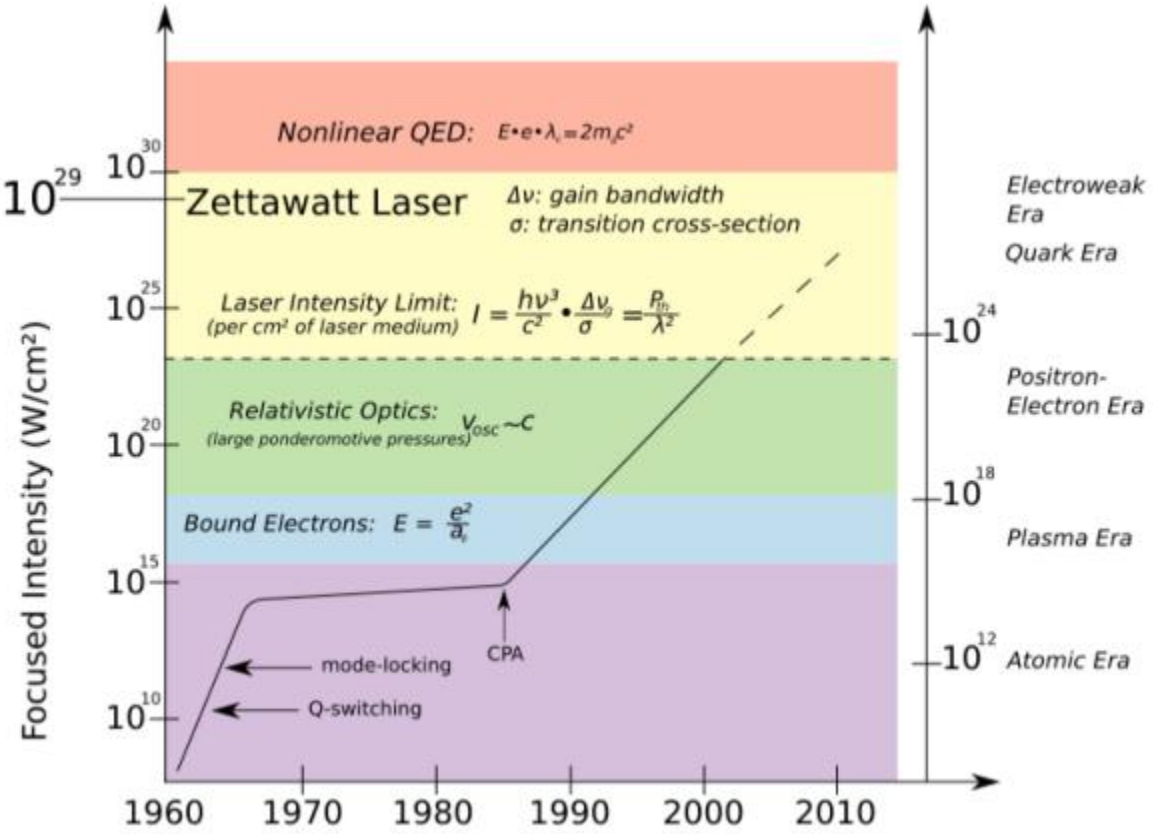
Further information and advice

For any further information or advice in respect of laser protection, or if you have a specific requirement that you need to meet our friendly office staff will be happy to help you.

Kent Periscopes Limited
90 Bowen Court
St. Asaph Business Park
Denbighshire
LL17 0JE
T: +44 1745 584480
F: +44 1745 584786
E: info@kentperiscopes.co.uk

Appendix - Reference data

The history of Laser Intensity over time



violet	380–450 nm
blue	450–495 nm
green	495–570 nm
yellow	570–590 nm
orange	590–620 nm
red	620–750 nm