LASER TECHNOLOGY

AND THE ABSENCE OF NEGATIVE EFFECTS ON THE HUMAN BODY AND MEDICAL EQUIPMENT

ENGLISH

What is LASER technology?

LASERs, compared to other components used to emit light, have two unique advantages.

The first one is the very high density of energy: a high amount of light is generated over a very small surface.

This allows concentrating the light on a very low area in order to get a very high spatial resolution. Moreover, the total amount of energy available can be in some order of magnitude higher than with other conventional light emitters.

The second advantage is that the LASER used as light emitter is very fast. This means that the LASER can generate very short pulses of light, as small as 5 ns, allowing a high temporal resolution.

These two advantages allow using a new technique which is called time of flight.
The time of flight is linked to the speed of light c.

When a pulse of light is generated, it propagates over free space at the speed of light and the distance of travelling during a time t0 is: D = c t0

Then, by measuring the time taken by a light pulse to go to a target and travelling back to a sensor, it is possible to measure the distance of the target by the following formula: D target = c (tfly /2)

The factor 2 is caused by the go and return path.

As the time can be measured with a very high accuracy (1 ns), and since the speed of light is a constant, the distance measurement is also very accurate and can be as low as 3 cm.

Why do we call it LASER scanner?

Having a very high spatial resolution can be seen as an advantage but it also represents a huge drawback.
The pattern of view of a LASER sensor is very low. In order to compensate this drawback, a scanning system consisting of a spinning mirror is set.

This mirror will deviate the LASER beam over an angle up to 100 ° covering more than a quadrant.

Extended over the distance measurement range, this will define a part of a plane (a quadrant). There are 4 different tilted mirrors forming 4 cubic sides.

The scan leads then to 4 separated planes shaping a 3D vision area.

Is the LASER sensor dangerous?

As the density of energy in the LASERs in general, is very high, it can be potentially hazardous for the eye and for the skin.

The conditions and power levels under which a LASER system is safe, for eyes and skin, is described in the standard IEC EN80625. Generally the power level required to do harm to the skin is very high, and cannot be reached in the products produced by BEA. The standard defines several types of classes for the LASERs according to their level of hazard for the eye.

The most relevant classes applicable are the following:

Class 1: LASERs of this class are without danger for the eye due to their performances. The energy transported by the LASER beam is under the most limitative maximum permissible exposure.

Class 2: The Class 2 groups all low power devices in the visible spectral range (400 nm to 700 nm). LASERs in this class are without danger for the eye thanks to the natural reflex of the eye in case of dazzling. This includes also a protection when optical instruments are used to view the beam.

Class 3R: The accessible emission limit for this class is 5 times the one for Class 2 in the visible range (400 nm to 700 nm) and 5 times of Class 1 outside this range. These LASERs are regarded as a low level of hazard for the eye. It is however necessary to inform the users in order for them to take some basics protection measures.

The LASER sensors of BEA use two kinds of LASERs:
1. a high power LASER operating in the infrared (900 nm) for normal operation
2. a low power red LASER (650 nm) used for alignment during installation

The high power LASER beam (35 W) never stays at in the same position due to the rotation of the scanning mirror, the possible eye exposure is then very limited over time.

Furthermore, the LASER is pulsed and operates only 1/5000 of time which ensures that the global energy radiated remains low.
There is an internal monitoring process inside the LASER scanner, and once any parameter (rotation speed of the mirror, LASER overdrive) deviates from its normal range, the LASER stops shooting immediately. This system is called interlock.

When the device is open, another mechanism ensures that the LASER will never shoot again without maintenance.

The LASER radiation level was measured and certified by LASERMET Ltd. (Report # 934 of May 14, 2008).

The maximal radiated level for a pulse LASER was measured at 45 nano-Joules which is almost 4 times under the limit of 203 nano-Joules for these conditions.

The BEA LASER scanner will meet the requirements for Class1 LASER products to IEC/EN 60825-1(2001) under the normal operating conditions and those of single failure once the warning label and the user's guide contains information about LASERs and warnings.

When the visible red LASER beams are used for alignment during installation, the radiated power is such that the device is entering class 3R.

The radiated power is below 2 mW and is more than 2 times below the limit of 5 mW.

In order to warn the installation operator on this potential hazard, the following label is applied on the back of the LASER sensor:

Can we look into the LASER beams?

For the normal condition of use, it is allowed, but not recommended, to look directly into the LASER beam. The LASER beam is eye safe. When the device is in installation mode and the visible red LASER beams are on, the device enters the class 3R and looking into the beam must be avoided.

The hazard is however low and the possible exposure is limited by the eye reflex.

BEA's concern is always directed to safety. Therefore all devices are designed to offer the highest possible safety.

In order to be safe for eye vision, BEA devices comply with the standard IEC EN 80 625 -1 (2001).
This compliance is verified and certified by LASERMET Ltd.

Can the LASER sensor cause interferences with medical equipment?

The emission of the LASER beam radiation is limited to the vision pattern of the device, and has virtually no chance to interfere with medical portable devices.

Moreover, the skin penetration depth does not exceed a tenth of a millimetre and is harmless at this level of energy. The chance to interfere with hidden medical equipment such as pacemakers is nil.

Therefore, we can say that there is almost no chance that BEA LASER sensors would disturb medical equipments.

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