Safety Guidelines When Using the Focus3D Laser Scanner

Laser Safety

The FARO Laser Scanner Focus3D produces an invisible laser beam with a wavelength of 905nm. The average laser power maximum is 20mW and the beam divergence is typically 0.19mrad (0.011°). In accordance to the standard IEC 60825-1:2007, Ed 2.0, the FARO Laser Scanner Focus3D is classified as a Class 3R laser system. According to this standard, direct intrabeam viewing may be hazardous for the eyes when working within an area around the Class 3R laser system where the defined exposure limits are exceeded.

However, exceeding the exposure limits does not necessarily mean that an actual risk for injury exists. An analysis comparing the exposure levels of the eye that can be produced by the FARO Laser Scanner Focus3D with injury thresholds for the retina in order to assess the risk for ocular injury when exposure occurs, comes to the conclusion that „exposure of the eye under normal conditions, as well as for reasonably foreseeable worst-case conditions, should not induce ocular injury.” From a biophysical point of view, the FARO Laser Scanner Focus3D can thus be considered as eye safe and it would not be necessary to wear eye protection. An abstract of this analysis made by Seibersdorf Laboratories can be found in this manual in Appendix E: “Expert Opinion - Assessment of the Risk for Ocular Injury”.

However, depending on national regulation or work place safety legislation, it might be necessary to wear eye protection and to observe other safety measures when the defined exposure limits are exceeded and when exposure can occur. To enable the user to identify the laser hazard area (nominal ocular hazard area - NOHA) around the scanner within which the defined exposure limits are exceeded, the controller software of the Focus3D shows the actual valid eye safety distance (nominal ocular hazard distance - NOHD). We differentiate between the axial and the radial NOHD. The resulting NOHA surrounding the scanner can thus be described as a cylinder along the scanner’s Z axis of rotation, where the radial NOHD is equivalent to the cylinder’s radius and the axial NOHD is equivalent to its center line coming from the center of the scanner mirror (see Figure 3-1).
Both, the axial and the radial NOHD are dependent on the requested scanning resolution and quality (see “Setting the Scanning Parameters” on page 47 for more information). Figure 3-2 contains the axial and radial NOHD (in meters), repetition rate and pulse duration for all resolution and quality combinations that are available.
When working with the Focus3D you should be aware of the following laser safety measures:

- **WARNING:** This product employs a laser system. To prevent direct exposure to the laser beam, do not attempt to open the enclosure.
- **WARNING:** Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.
- Avoid looking into the direction of the laser. Avoid direct eye exposure, do not stare into the laser beam and do not direct it to other people.
- Do not view the laser beam directly with optical instruments.
- Do not place mirrors or objects with reflective surface into the beam. The mentioned safety measures are also valid for
the reflected laser beam.
• The scanner should be operated by trained personnel only.
• The customer should assess the proper functioning of the delivered Focus3D at regular intervals, each of which shall not exceed a maximum period of one year, which may occur via FARO customer service during the yearly maintenance and certification service. You should immediately stop the further use of the Focus3D if any failure is found.
• Respect the safety precautions and control measures that are specified in IEC 60825-1:2007, Ed 2.0. Also respect differences to the mentioned safety precautions and control measures that may exist in national or regional publications. Depending on national regulation or workplace safety (health and safety at the workplace) legislation, further laser safety measures might be necessary, such as:

• Personnel working in distances shorter than the NOHD must wear laser safety goggles.
• Prevent people without laser safety goggles from entering the NOHA (e.g. by using a safety fence).
• The NOHA should be posted with appropriate laser warning signs and should be demarcated.
• Companies working with Class 3R laser systems have to appoint a laser safety officer.

PLEASE NOTE: these mentioned laser safety measures raise no claim to completeness. Please refer to your national regulations and legislations for more information on required laser safety measures when working with Class 3R laser systems. If working with laser safety goggles, they must be selected for the specific type of laser. For the Focus3D, use goggles which are specified for D1 800-980 L5 or higher. D stands for continuous wave laser mode, I for pulsed laser mode, 800-980 describes the laser wavelength, and L5 is the L-rating, which is used to indicate the level of protection provided for specific wavelength ranges. Please refer to your laser safety commissioner for more information.

In accordance with IEC 60825-1:2007, Ed 2.0, the Focus3D is equipped with the following laser signs:
The Focus3D stays within the limits of laser class 1 if all instructions of this manual are obeyed, especially if no one is allowed to enter the NOHD without wearing laser safety goggles.