NKT Photonics
A HAMAMATSU COMPANY

Laser Safety, Handling, and Regulatory Information

MUST READ: Never operate the BOOSTIK HP amplifier and its system components until you have thoroughly read this document and the laser system's operation guides. A Class 4 laser is dangerous and has the potential to cause damage and injury. Considering this, ensure that you take all precautions possible, including being fully familiar with and following all the safety recommendations listed here.

Laser Classification

The optical output delivery of a BOOSTIK HP amplifier is classified as a Class 4 laser as per the IEC/EN 60825-1:2014 laser safety standard and complies with IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use. All compliances are listed under "Regulatory Compliance" on page 2.

Intended Use

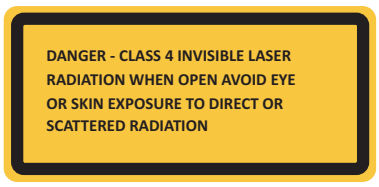
Koheras BOOSTIK HP laser amplifier systems have been designed for general laboratory or industrial use and as such are not approved nor tested for use in treatment or diagnostics of human or animals and do not comply with European, US or rest of the World requirements for medical device lasers. Neither is the system appropriate for outdoor use or use in extreme conditions such as elevated/lowered temperatures, particle/chemical contaminated environment or vacuum conditions.

Laser Safety Officer

The laser system should only be used by staff familiar with laser safety procedures and in facilities appropriate for laser operation. NKTP recommends appointing a Laser Safety Officer (LSO) in accordance with valid local and national safety regulations. The LSO should ensure that every user of the system is familiar with the safety aspects of the laser amplifier unit, its associated system devices, and that the laser system's operation documents should be clear and present to operators of the laser system. Furthermore, any other staff in close proximity of the laser system should be aware of any risk in connection with usage of the unit.

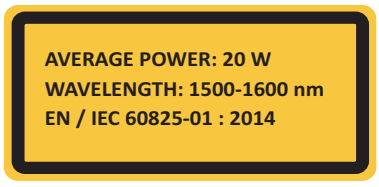
Safety Labels

The following labels are fixed to the device chassis. For safe operation of this laser amplifier, you must be aware of the location and the meaning of each label. Refer to the laser amplifier's *Product Guide* for further information on the labels and their location.



Panel Warning

Explanatory



Radiation output and standards

Manufacturing

Laser aperture

Laser radiation warning

Warnings

Warning: This laser amplifier is a Class 4 laser product and as such the operation room and operation conditions must comply with CFR21 1040.10, Laser Notice LN56, & IEC / EN 60825-1. If these regulations are not followed you must operate the laser amplifier in accordance with local regulations for a Class 4 laser source.

Warning: Using controls, making adjustments, or altering the procedures other than those specified by guides associated with this laser may result in exposure to hazardous radiation and/or voltages.

Warning: The Koheras BOOSTIK HP emits a Class 4 collimated laser beam from a collimator at the end of the amplifiers output fiber. Both a laser aperture and a radiation warning label is affixed at or near to the emission aperture. To prevent injury, the beam path must be strictly controlled.

Warning: Using this equipment in a manner not specified by the manufacturer may impair the protection capabilities of the equipment.

Warning: At all times the system is ON, it is advised that you have clear access to the shut-off controls of the system. Shut-off controls consist of the front panel key switch, the mains cable of the power supply (unplugging it), an AC mains power switch, emission controls on the front panel of the seed laser system, or within the application user interfaces.

Warning: At all times during system operation, ensure that the beam path is known and controlled. Wear wavelength specific eye and skin protection and ensure everyone in the laser area is aware that the system is in operation. Ensure the remote interlock is in place.

Warning: The system should only be operated by authorized users who are properly trained in the appropriate safety aspects and of statutory minimum age. To prevent unauthorized and likely unsafe operation by untrained personnel, remove the front panel key from the key switch when the system is not in use. Store the key in a secure location.

Warning: It is not recommended that you operate the system without an appropriate interlock connection to for example, a door or other entry mechanism to the system enclosure. If you bypass this safety feature, NKT Photonics bears no responsibility for any damage, loss or harm caused by accidental laser exposure.

Warning: Never make any modifications, additions or conversions which might affect safety. This also applies to the installation and adjustment of safety devices. Should safety relevant modifications or operational behavior changes occur with the laser amplifier, shut down the laser system immediately and report the malfunction to NKT Photonics A/S.

Damage Prevention

Caution: If the laser amplifier's full or partial beam is obstructed or guided towards flammable materials, it can ignite a fire. Flammable materials include paper, solvents or other similar combustible material. Keep the beam path free from any combustible material and keep a fire extinguisher nearby the laser system operation area.

Caution: Avoid spilling fluid onto the laser seed source, amplifier and accessories. If spillage occurs, remove it immediately using absorbent material. Do not allow spilled fluid to enter into the chassis.

Caution: Avoid spilling fluid onto the electrical system. Place the laser system so that in the event of a spillage, the electrical sockets' exposure is minimized.

Caution: Always clean the surface of the equipment with a soft damp cloth or IT equipment tissue only. Disconnect the power supply before cleaning the unit.

Caution: **Protective Equipment**

- Laser Safety Officers are also responsible for the issuing and/or wearing of personal protective equipment. Direct exposure of the eye to the invisible laser beam must be avoided. At all times, proper eye-wear must be worn and maintained according to Personal Protection Equipment at Work regulations.
- Compulsory regulations also require the issuing and/or wearing of personal protective equipment. The necessity of reading the laser's documentation applies especially to persons working only occasionally with the system.
- Use protective equipment, wherever required by the circumstances or by law.

Caution: **Servicing the Laser:**

- There are no user serviceable components inside the system. In case of malfunction, NKT Photonics should be consulted.
- The unit is sealed with a "WARRANTY VOID IF REMOVED" label and it is thus strictly prohibited to remove the chassis cover.

Caution: **Storage:**

- If required, the laser amplifier should be stored in a dry and cool place (15-20°C).
- The optical output should be protected using the mechanical shutter on the front panel of the chassis.
- Avoid exposing the unit to vibrations or mechanical shock.

Caution: **Chassis Cleaning**

- To clean the chassis, disconnect the power source and use a soft damp cloth or IT equipment cleaning tissue. Do not use solvents or similar cleaning agents on the chassis or any other parts of the system.

Caution: **Emergency Response:**

- In the event of an emergency or accident, make sure to have a contingency plan prepared and readily available including response actions and contact persons.

Caution: **Disposal**

- When disposing the system, follow local waste regulations. See "Disposal" on page 4.

Regulatory Compliance

CE Mark – Declaration of Conformance

The laser amplifier listed in this document comply with the requirements of the Council Directive 2014/30/EU in approximation of the laws of the Member States relating to safe design, use and implementation of lasers, electromagnetic compatibility and the safety of electrical equipment used within certain voltage limits. To evaluate the compliance with these directives, the following standards were applied:

Safety:

- EN 60825-1:2014+A1:2021 (laser Class 4) Safety of laser products - Part 1: Equipment classification and requirements
- EN 61010-1:2010+A1:2019 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: general requirements
- Low Voltage Directive: 2014/35/EU - Requirements to ensure that electrical equipment within certain voltage limits provides a high level of protection.

EMC:

- EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use – EMC requirements
- EMC Directive: 2014/30/EU Electromagnetic compatibility - Requirements to ensure that electrical and electronic equipment does not generate, or is not affected by, electromagnetic disturbance.

Environmental:

- RoHs directive: 2011/65/EU, 2015/863 - On the restriction of the use of certain hazardous substances in electrical and electronic equipment.
- REACH: Directive EC 1907/2006 Registration, Evaluation, Authorization and Restriction of Chemicals

CE Approval

The Declaration of Conformity (DoC) and IEC certificates can be downloaded from:

https://www.nktphotonics.com/product-manuals-and-documentation/

EMC test USA:

- FCC Part 15, subpart B

Safety Instructions Governing Specific Operational Phases

Precautions

Take the necessary precautions to ensure that the system is used only when in a safe and reliable state. In the event of malfunctions, disable the laser amplifier immediately and unplug its electrical power. Have any defects rectified immediately.

Before starting the laser system, prepare a site specific risk assessment to ensure no persons are at risk. Inform operating personnel before beginning special operations, and appoint a person to supervise the activities. Ensure that the user operation area is adequately secured.

Specific Safety Aspects

Specific safety aspects are:

- Physical hazards related to the system. See the following section: Physical Hazards.
- Protection of the system users against physical hazards. See Section Personnel Safety.
- Proactive measures against these hazards. See the following section: Constructive Safety Features.

Within this classification, the laser amplifier is a Class 4 laser, and is a potential hazard to the human operator. A laser beam from a Class 4 laser is also classified as a potential fire hazard. Direct radiation from Class 4 products are a hazard to eyes and skin. Precautions include eye and skin protection, remote interlocks and warning labels.

Physical Hazards

Warning: The laser beam is dangerous to the eyes and skin. The dangers include:

- Direct radiation as it leaves the laser amplifier.
- Radiation reflected from a surface.
- Diffused radiation originated from a scattered reflection.

Light

In case of exposure, the laser amplifier may provide laser radiation with power levels up to 15 Watts. The laser amplifier's emissions consists of wavelengths at either 1064 nm or 1550 nm ranges. The emission is a collimated beam from the output aperture of its collimator. Despite the non-ionizing nature of the operating wavelengths, damage can still occur to living tissue as a result of heat produced during radiation absorption or via multi-photon absorption. Suitable beam dumps must be used at all times when the laser system is operating.

In general, the maximum permissible radiation exposure for the skin is several times greater than for the eye. Safety measures with regard to the radiation hazard are therefore mainly focused on dangers for the eye. Not only is the direct laser beam hazardous, but unchecked reflections of laser light also constitutes a potential hazard.

Personnel Safety

Personnel Protection

Warning:

Risk of serious injury: Always wear wavelength specific laser safety glasses when there is a chance of exposure to radiation from the laser amplifier. The filter in protective eyewear provides protection for only a narrow band of wavelengths. Ensure you are wearing the appropriate protective eyewear for the laser device in question. Check with your Laser Safety Officer or other safety personnel for guidance in selecting the appropriate eyewear.

For protective eyewear, the American National Standards Institute (ANSI) standard for the safe use of lasers requires that a set of protective eyewear blocking the appropriate laser wavelength should be worn while operating or servicing devices rated as Class 4 lasers.

Clearly label safety eyewear with their optical density and their specified wavelength protection. To avoid confusion, laser safety eyewear should be kept separate from any other safety eyewear and personal protective equipment.

Using the wrong type of safety eyewear is dangerous. It can be more dangerous to have improper eyewear and a false sense of security than to have no eyewear and take precautions based on the absence of protection. Even if you are wearing protective eyewear, never look directly into the beam; intense laser radiation is capable of destroying the protective filter.

Eye Protection

Warning:

Potential eye burns: Only use the laser system in accordance with its designated use.

The following guidelines describe some of the actions necessary to avoid injury caused by the laser beam. Always follow these guidelines and take additional precautions if necessary.

When eyewear is necessary, make sure it has the proper optical density for the laser wavelength.

All other personnel in the vicinity of the laser system must wear protective eyewear.

Permit only qualified personnel to operate the laser system.

Never look directly into any laser beam.

Avoid indirect viewing of direct or reflected laser radiation. Specular and diffuse reflections (from reflective surfaces) can be as dangerous as the direct laser beam. Never view the beam directly through optical instruments.

Take precautions to ensure that there are no reflecting objects in the path of the laser beam.

Do not deviate from standard operating procedures when working with Class 3B and Class 4 laser equipment.

Use lasers only in approved applications and locations. Take adequate precautions to prevent unauthorized personnel from entering the area where a Class 4 laser is operating. Do not use lasers around untrained personnel. Ensure that all personnel in the area observe proper safety precautions.

Report all incidents of exposure to your supervisor.

Clearly display warning signs indicating the laser system enclosed area with an additional warning light outside the door.

Adhere to local and national regulations governing the safe use of lasers.

Be aware that maintenance of eyewear includes, but not limited to: inspection, cleaning, testing and training in use. Maintenance should only be performed by competent personnel.

Skin Protection

Warning:

Potential skin burns: if the laser beam is kept motionless for a long period it can burn exposed skin. Only use the laser in accordance with its designated use. Safety interlocks are only to be overruled by authorized personnel.

Although the skin can withstand considerably higher radiation intensity than the eyes, tissue may be burned to a greater or lesser degree, depending on the radiation time and the irradiation intensity.

Avoid contact between the skin and the beam. Reflections of the beam may be as dangerous as the beam itself. Wear appropriate protective clothing to protect the skin whenever necessary.

Fire Protection

Warning:

Fire hazards: Class 4 laser devices are potential fire hazards. The laser beam can cause flammable materials to ignite or explode. Always keep a fire extinguisher in the laser system area in case a fire occurs.

Because of the high output power from the Class 4 laser amplifier, a wide range of materials can be set on fire. Therefore, take appropriate fire prevention measures when the beam path is open:

Combustible materials may be ignited by the laser beam or by electrical components inside the laser system. Flammable items must be isolated from the laser beam and from the laser system.

Paper (circuit diagrams, leaflets, or even posters on the wall), curtains that are not coated with fire retardant, wooden panels or similar materials can be easily set on fire by direct or reflected laser radiation.

Use only beam stops made of non-flammable materials (not asbestos!).

Many fluids and solvents (e.g. cleaning agents used for maintenance) are combustible. The intense beam emitted from the laser amplifier can ignite vapors from these materials. Prevent the laser beam from contacting flammable materials used in the operational area of the laser system.

Move containers of flammable materials as far from the laser system as possible and shield them from the beam with opaque materials. Never place these solutions and vapors in the beam path or near the system.

Constructive Safety Features

Safety Features

Appropriate Class 4 label affixed to laser device enclosure – see section Safety Labels.

All parts of the laser system where laser radiation may possibly escape are marked with the appropriate adhesive danger signs (according to IEC 60825).

The laser system has an emission indicator LED fitted that indicates laser energy is present or can be accessed.

The laser system is equipped with a safety interlock system. In case of an emergency, the laser system is fully switched off (no laser emission) by breaking the interlock line.

Quality Compliance List

All NKT Photonics products are produced under our quality management system certified in accordance with ISO 9001:2015 and in some cases, also in accordance with ISO 13485:2016.

Disposal

Within EU territory

NKT Photonics follows the European directive on Waste of Electrical and Electronic Equipment or WEEE. The WEEE symbol affixed to the front of the laser and as shown within this document means that upon retirement of the equipment it must not be mixed with general waste.

For proper treatment, recovery, and recycling, please contact our support team to arrange returning the laser to us. The laser will be accepted and disposed of according to WEEE regulation.

Outside EU territories

The WEEE symbol is only valid within the European Union. To discard this product please contact your local authorities or dealer and ask for the correct method of disposal.