

Diode Laser System - Introduction / Safety Requirements

Laser is an acronym for- Light Amplification by the Stimulated Emission of Radiation. Laser light differs from typical light waves in that it is coherent, the wave energy is all in the same wavelength and all in phase. Laser light is produced by stimulating atoms in a material to emit photons with the characteristics of identical wavelength and phase. The first lasers were produced in the 1960s using ruby rods. Flash tubes were used to stimulate the atoms in the rods to produce the desired effect. Since then, many materials have been used to produce lasers including transparent, non-conducting crystals such as yttrium-aluminum-garnet (YAG). Another form of crystal laser is the semiconductor diode laser. The semiconductor material is stimulated by passing a current through the crystal which has been doped with a suitable material. Diode lasers produce wavelengths from 375 nanometers (nm) to 1800 nm. Low power diode lasers are used in laser printers and CD players. Higher power diode lasers are used in industry for cutting and welding. Diode lasers are also used in medical applications including performing delicate surgical procedures on the eye.



The IRIDEX (<http://www.iredex.com>) Oculight SLx solid state infrared diode laser system is used by ophthalmologists to treat eye injuries and other eye disease maladies such as retinal tears, refractory glaucoma, ocular tumors and choroidal lesions. The system allows the clinician to select the pulse intensity, duration and interval in three modes of operation: CW-pulse™, MicoPulse™ and LongPulse™. The system will be used in



the Ophthalmology Augmentation Unit Assemblage (N419) to augment the Head and Neck Specialty Medical Teams. The Oculight SLx system includes the Laser Console with footswitch, Endophotocoagulation Probes, Laser Indirect Ophthalmoscope (LIO), and Operating Microscope Adapter (OMA) with Zeiss dovetail. The system uses an infrared laser produced by two solid state diodes. The laser energy is transferred from the console to the delivery device through fiber optic cables. The system outputs 810 nm wavelength at power levels between 50 and 3000 milliwatts (mW) dependent on the attached delivery device. The 810 nm laser

is in the infrared spectrum and is not visible. An aiming laser, 650 nm at <1 mW (visible spectrum), is added to the treatment beam to make the beam visible. The system is classified as a Class IV Laser. It presents severe hazard to eye and skin. Safety, more specifically, eye safety, is critical when operating/maintaining the system.

The SLx Console Safety Mechanisms:

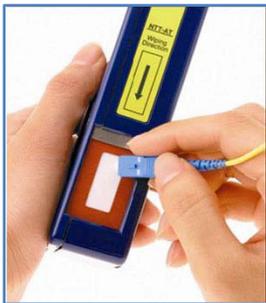
- The console must be turned on using a key. When the system is off the key should be stored in a safe place to prevent unauthorized use.
- The console always powers up in standby mode. The user must press the treatment button to initiate treatment mode. The footswitch is locked out for three seconds whenever treatment mode is initiated to reduce the chance of unintended output.
- A remote interlock capability is built into the console. This allows a simple switch to be applied to the door of the treatment room. When the door is opened the laser is locked out. When not used a remote interlock plug must be installed on the rear of the console.
- The console has an emergency stop button. When pressed the console shuts down and the key switch must be toggled to allow further operation.
- The console automatically senses the delivery device attached to the fiber output port. Each delivery device has an internal resistor which is sensed by the port and allows the console to control the range of output settings for the intended device.
- The console emits an audible tone when the laser is initiated. The tone can be turned down on the rear of the console but can never be completely turned off.
- The console has a beam attenuator that prevents the treatment beam from exiting the console until all requirements for emissions are met and the footswitch is depressed.

Laser Safety Considerations:

- Never attempt to disable or bypass any of the safety features of the console. This may result in injury to the user or patient or may result in damage to the console.
- Never look directly into the laser aperture or at scattered laser energy. Never look into any of the delivery device apertures.
- Always wear appropriate laser safety eyewear such as GPT Glendale Laser Safety Eyewear (<http://www.glendale-laser.com>). Never substitute any other safety eyewear for laser safety eyewear. Laser safety eyewear must have a minimum optical density of O.D. 4.0 and be suited for wavelengths of 800-840 nm. Verify all safety eyewear by checking the O.D. and wavelength rating on the frame, close is not acceptable.
- Do not use in the presence of explosives, compressed oxygen, or flammable materials.
- Always keep the laser in standby mode or turned off and key stored when not in use.
- Only properly trained individuals should operate or maintain the system.

Maintenance Considerations:

The output power of the system should be verified semiannually. Use a suitable laser power meter and power sensor (air cooled thermopile sensor). The Ophir (www.ophir-spiricon.com), Nova II Laser Power meter with 150C-SH power sensor are recommended. A new or known good endoprobe should be used when checking the laser output. This probe can be kept in the BMET shop for future testing.



Proper care of the fiber optic cables is critical. Never coil fiber cables to less than a 6 to 7 inch loops. Handle cables with care, never kink, bend, or twist cables. Replace any suspected defective cables. Never touch the ends of the fibers. Always keep the fiber end caps installed when fibers are not in use. Clean fiber ends with an optical connector cleaner such as the Optipop R Series Optical Connector Cleaner (http://www.ntt-at.com/products_e/optipop/index.html), lens paper, or lint free swabs. Use only high grade 100% ethanol or methanol. Cable ends can be polished with fiber optic lapping film. (http://www.ripley-tools.com/tools.php?tool=FO_Polishing_Kit&category=Fiber)

Delivery device lens must be kept clean and dust free. Use canned air and lint free cloth/swabs to keep the lens clean. Dirty lens and dirty fibers will absorb laser energy and create heat which will cause further damage.

The diodes themselves are extremely sensitive to static electricity. If for any reason the diode cable connectors (J4/J5) are disconnected from the Control PCB the pins of the connectors must be shorted together. If this is not done immediately after disconnecting the cables the diodes will be destroyed. The laser head assembly cannot be adjusted, aligned or repaired in the field. The Control PCB will need to be replaced with the laser head assembly if either fails. They are a matched set and are adjusted together during factory alignment.

Laser Head Assembly

Connector J4/J5

Aiming Diode

Laser Diodes

Laser Output Port

