Laser Safety

High powered diode lasers emit radiation in the visible and infrared region of the spectrum. When in use, safety pre-precautions should be taken, to avoid possibility of eye damage. For Class IV lasers, extreme care must be exercised during their operation. Do not allow exposure of the eye or skin to direct or scattered radiation. If viewing is required, the beam should be observed by reflection from a matte surface, utilizing an image converter or a suitable fluorescent screen. Serious injury may result if any part of the body is exposed to the beam. The eye is extremely sensitive to the infrared radiation and therefore, proper eyewear must be worn at all times.

Specific Handling Precautions

1. Post warnings in the area where the laser beam passes to alert those present.
2. Keep all unauthorized personnel out of the area where the laser is operated.
3. Whenever the laser is running and the beam is not in use, it is a good practice to mechanically block the radiation path.
4. Never look directly into the laser beam path or scattered laser light from any reflective surfaces.
5. Never look directly into the laser source.
6. Maintain experimental setup at lower level to prevent inadvertent beam-eye contact.
7. As a precaution against accidental exposures to the laser beam or its reflection, operators should wear laser safety glasses with sufficient attenuation at the laser emission wavelength.

General Handling Precautions

ESD

Laser diodes are very reliable under normal operating conditions. However, like most semi-conductor devices, they can be easily damaged or destroyed by inadvertent electrical or static discharges. Laser diodes are very sensitive to electrostatic discharge (ESD) and may suffer latent catastrophic damage unless they are handled according to proper ESD procedures. Latent damage is usually due to breakdown of the P-N junction in an area of the device outside the optical cavity. Defects in the active region of the junction from ESD or electrical over-voltage may propagate with time into the laser cavity. The resulting decreased performance of the laser may appear immediately, or long after the damage occurs. A static free environment is mandatory. Grounded tweezers and a grounded wrist strap on the user, a grounded work surface, anti-static floors and case ground for the laser diode all reduce risk of damaging static discharge through the diode. Retain the laser diode in a static fire environment when not in use (such as the shipping container). Short the pins on packaged diodes at all times when not in use. Wrap wire from pin to pin. (Note: A laser that is not shorted can be damaged by ESD even without touching it!). The user should never try to service and repair the device without authorization of Apollo Instruments. Apollo Instruments is not responsible to any damages resulted by unauthorized repair and services. Any attempt to opening the laser unit will void the limited warranty to the device.

Excessive Forward Current

Excessive forward current can cause operation at optical power levels which may damage the output facet in less than 1 msec! Laser action may continue after this damage at lower efficiency and lower power, or only spontaneous emission may remain.

Reverse Currents

Reverse currents may also damage a laser diode, sometimes with no change in the reverse-current vs. voltage characteristic. Forward or reverse transients may be caused by energy reflections in driver systems, capacitance in fixtures or cables, or output capacitors in constant current supplies operated with no load connected. Drive levels on drivers for moderate power cw laser diodes may be tested by using a dummy load.

Excessive Voltage

The diode junction may be damaged by forward current greater than the specified limit, or any reverse voltage. This problem is solved by putting a diode across the output of the power supply. Most commonly, these conditions occur from static discharge or from tum-on or range-changing voltage transients in laboratory power supplies. Many power supplies, even current regulated, exhibit very fast voltage spikes when switched on or off. The following precautions are recommended to minimize the risk of destructive electrical transients occurring:

a. Reduce static charge accumulation by wearing a grounded wrist strap when handling laser diodes.
b. Use a grounded work area, and store the laser diodes in their original shipping packages when not in use.
c. Eliminate transient power supply spikes by using a power supply specifically designed for operation of laser diodes, or other "slow start" power supply.

Cooling

High power laser diode requires an adequate heat sink or efficient cooling. Failure to supply an adequate heat sink or cooling will destroy the device. For air cooled devices, the fiber-coupling laser diode case should remain temperature at or below 25°C during normal operation. For a passive-cooled device (non-water-cooled), there must be a good temperature control or monitoring. For water cooled device, an adequate cooling circulation is crucial.