

OPTICAL FIBER COUPLING AND COUPLER ALIGNMENT GUIDE



Caution-Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

Safety Information

Always take appropriate safety precautions when working with Class IIIb or Class IV lasers. Failure to do so could result in irreparable retinal damage or other serious injury. It advises that all operators and/or personnel who could potentially be exposed to laser radiation review the various jurisdictions, standards, legislation, and government regulations that define appropriate safety measures for the types of lasers that are being operated. It also strongly recommends the appointment of, and guidance by, a certified Laser Safety Officer when using any lasers in the workplace.

It urges all users to exercise caution when using lasers and laser devices. In this guide, a 80mW visible laser is used. Remember to take special precautions when using invisible wavelengths or very high powers.

Optical Fiber Coupler Overview

Optical Fiber couplers are optical components that are designed to allow a free - space laser beam to efficiently enter an optical fiber. Their design is simple: A focusing optic is used to reduce the beam to as small a waist as possible, and the input aperture of the optical fiber is attached at the focal point so that the largest amount of optical power possible is sent into the fiber. While there are many different kinds of fibers and fiber couplers, this guide will focus on couplers and fibers available. The four basic elements of a fiber coupler are the coupler body that attaches to the aperture of the laser module, the focusing optics located inside the fiber coupler body, and the fiber port platen held in place by three hex cap screws on coupler.



Figure 1-An optical fiber coupler



Figure 2-A 473nm laser module with
optical fiber coupler attached

Clean the tip of the optical fiber

It is necessary to clean the tip of the optical fiber before using the optical fiber.

1. Remove the optical fiber safety covers, then clean the tip of the optical fiber (Use the cotton stick dipped with the mixture of ethanol and ether, the ratio of the two liquid is 1:2). Ensure the tip of the optical fiber is clean, then using the optical fiber.
2. Never touch the tip of an optical fiber or allow the fiber end(s) to touch any surface. It is necessary to clean the tip of the optical fiber again if it is smudged.

Fiber Coupler Alignment

To maximize the amount of laser light entering the fiber, the coupler will need to be aligned. It aligns all fiber couplers prior to shipping, but couplers may become misaligned during shipping and when used or stored in areas with vibration or large changes in temperature. If your laser is not producing the expected level of output at the output aperture of the optical fiber, realignment may be needed.



Figure 3-Laser warming up with no fiber attached

To realign the fiber coupler:

1. Remove the optical fiber from the coupler, but leave the coupler attached to the laser.
2. Turn the laser ON at full power. The laser output will be highly divergent due to the focusing optic inside the coupler (Figure 3). Allow the laser to warm up for at least 5 minutes, 20 minutes is recommended. Be sure to dump the output beam in a safe manner using a beam stop.
3. Using a laser power meter, check the output power of the laser without the optical fiber attached. Ensure the laser is producing close to (or more than) the output power provided in the laser system specifications and printed on the laser itself.
4. Attach the optical fiber to the coupler. Ensure the optical fiber safety covers have been removed before affixing fiber to a coupler or



Figure 4-Checking laser output power

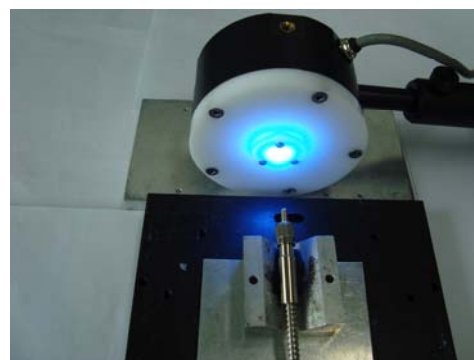


Figure 5-Alignment completed

attempting to calibrate the fiber optical output. Never touch the tip of an optical fiber or allow the fiber end(s) to touch any surface.

5. Using your fingers, slide arbitrarily two cap screws on the coupler until optical output is observed from the aperture of the fiber.

Note: Turn the one cap screw counter-clockwise, turn the other cap screw clockwise.

Gently slide the cap screws left or right to achieve maximum output (Figure The fiber will have the greatest output when the center of the fiber is located exactly at the focal point of the laser beam. Please note that this may not be exactly in the centre of the coupler (Figure 5).

To adjust the focusing optic:

1. The focusing optic is located on a threaded plate in the center of the coupler. Please rotate the mirror base in the connection. Be sure do not touch the optical elements but do not rotate more than half a circle every time (Figure 6).
2. If slide the cap screws in either direction results in a lower maximum power, the focusing optic is aligned.
3. Clean the mirror on the fiber connection.(Use the cotton stick dipped with the mixture of ethanol and ether, the ratio of the two liquid is 1:2). Then connect the fiber coupler to the laser, and do the procedures above again until the maximum output power is obtained.
4. It recommends do not use other glues or adhesives as they may produce invisible gas while curing which may permanently damage the optical components.



Figure 6-Focusing optic base

Alignment Tips:

1. The smaller the core diameter of the fiber, the more difficult it will be to align.
2. Single mode fiber (<10 μ m core) will be very difficult to align using the standard fiber coupler and will very easily become misaligned during shipping. It typically will epoxy the coupler and fiber in place prior to shipping so as to minimize misalignment.
3. Fiber couplers can be removed from the laser head by gently unthreading them counterclockwise.
4. Tightening the cap screws only partially will allow the cap screws to be moved without falling out of place when you let go. If rough alignment has been made, consider partially tightening the screws and making fine adjustments before tightening the screws fully.
5. Extremely fine adjustments can be made by fully tightening the cap screws and then Vibrate the fiber coupler of the laser head slightly. Each vibration will cause the plate to move by fractions of a micrometer which can prove quite useful when aligning single-mode fiber. Never use metal objects to move the fiber port platen or the vibration and shock could damage the optics or electronics of the laser.
6. Damaged fiber may produce the same symptoms as a misalignment. Try replacing the optical fiber if problems persist.
7. Due to the very small size of the optical path of a laser, small amounts of debris such as dust, hair, or other materials on the optical surfaces can cause significant optical variation therefore all procedures should be done in a clean, dust-free environment.