



BLUE/ DIRECT GREEN LASER INSTALLATION GUIDE

Revision 1.0

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WARRANTY CONDITIONS

All Necsel laser products are inspected, tested and certified before they are shipped to the customer. Necsel warrants that the laser and controller at the time when the risk passes over to the purchaser are not affected by defects that will insignificantly cancel or deteriorate the value or the suitability for ordinary use or the use authorized by the contract. If not contractually guaranteed, the time of warranty is 6 months.

Depending on the character of the laser and its properties a decrease of optical power up to 50% within the warranty period on constant current is not a reason for any warranty claims.

The purchaser is responsible for correct cooling of the Necsel laser product. Appropriate cooling, typically in the 20°C to 25°C range, is a prerequisite for obtaining a stable power. Varying power due to improper cooling is not a reason for any warranty claim.

Necsel will not honor any warranty claim for damages caused by unsuitable or improper use, non-observance of indications for application or by defective or negligent handling as well as by natural wear.

Lasers that have any visual evidence of mishandling will not be replaced, even if this was not the initial reason for returning the unit. This evidence is as follows:

- ▶ Contaminated or scratched thermal contact surfaces, even if no other mishandling is assessable because these defects influence the laser characteristics by increased thermal resistance.
- ▶ Contaminated or damaged front window of the laser package.
- ▶ Burned spots on the laser die emitters caused by excess current, current transients or deposited particles burning the facets by absorbing the laser energy.
- ▶ Electro-static discharge [ESD] damage.
- ▶ Mechanical damage (e.g. deformed heat sink, kinked or torn cables, broken or re-attached parts)

Necsel deliveries have to be inspected after receipt. Non-merchants must report an obvious defect within two weeks in writing stating the laser serial number and P.O. number, otherwise the warranty is excluded.

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LASER SAFETY

WARNING: Direct eye contact with the output beam from the laser will cause serious damage and possible blindness

Please observe proper laser safety at all times when operating Necsel lasers. Necsel lasers are Class IV devices in the visible spectrum.



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TIPS AND TRICKS

Below are easy to follow guidelines to remember when using the Laser:

- Do NOT open the Laser (Void warranty if laser cover is removed)
- Do NOT break or cut the transport fiber
- Do NOT remove the transport fiber from the Laser while the driver is on or lasers are engaged
- When the laser is not connected to the transport fiber be sure to replace the dust caps on the laser and fiber **IMMEDIATELY** to avoid damage to the optics
- Always remember to actively cool the laser while running, otherwise this could result in over heating the laser and damage the laser

Beams are powerful enough to burn skin, clothing, or paint. They can ignite volatile substances such as alcohol, gasoline, other solvents, and can damage light sensitive products such as a camera. The laser beams heat can ignite substances that it shines on or indirectly by reflecting off of a polished surface. Below are safety precautions that are advised to follow when working with or in the vicinity of lasers.

- Extreme caution should be exercised when using solvents in the area of the laser
- Limit access to the laser to qualified users who are familiar with laser safety practices and who are aware of the dangers involved
- Never look directly onto the laser light source or at scattered laser light from any reflective surface. Never sight down the beam into the source
- Maintain experimental setups at low heights to prevent inadvertent beam-eye encounter at eye level
- As a precaution against accidental exposure to the output beam or its reflection, those using the system should wear laser safety glasses
- Avoid direct exposure to the laser light. The intensity of the beam can easily burn skin or ignite clothing
- Use the laser in an enclosed room. Laser light will remain collimated over long distances and therefore presents a potential hazard if not confined.
- Post warning signs in the area of the laser beam to alert those present
- Advise all those using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access

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CONNECTING THE LASER

CONNECTING THE FIBER COUPLED LASER TO THE CONTROLLER

1. All laser currents must be turned off before connecting the device or there is a high risk of damage to the laser
2. Remove the laser from its anti-static bag or trampoline case
3. Insert the connection cable into the driver
4. Remove the shorting connector from the laser and insert the connection cable until it clicks in
5. When removing the connection cable or shorting clip, excessive force may cause the connector to be pulled out of the laser, always hold the connector when removing the cables or shorting clip



Figure 1: Blue laser connector and shorting

NOTE: Take proper precaution when handling the laser device. It is recommended to wear a static wrist strap to ground yourself and never touch the electrical pins. When handling the laser hold it by the case.



Figure 2: Connection Cables
Note: This is the old connector

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COOLING AND MOUNTING

COOLING OPTIONS

Necsel does not specify to the customer how they should cool the laser. However, Necsel does provide thermistor interfaces and the temperature at which the laser should be run on the data sheet and recommends mounting the laser onto a chill plate.

There are many options to cooling the laser such as

- TECs
- Liquid chillers
- Heat pipes
- Fans

MOUNTING & COOLING THE LASER

1. Place a piece of thermal conductive material, such as grafoil, between the cool plate and the base of the laser
 - a. This is not necessary for the blue laser, however the chill plate will have to be actively cooler to a lower temperature.
2. Screw each of the corners of the laser hand tight, before fully tightening opposite corners. This ensures that your laser is equally mounted to the chill plate on all four sides
3. It is recommended to keep the chill plate at a constant temperature to reduce experimental variables
4. Refer to the laser specifications sheet for specific temperature cooling requirements

NOTE: Take proper precaution when handling the laser device. It is recommended to wear a static wrist strap to ground yourself and never touch the electrical pins. When handling the laser hold it by the case.

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HANDLING THE TRANSPORT FIBER

A dirty or damaged transport fiber can cause reduction in output power or permanent damage to the laser device. Each fiber end is highly polished (sometimes with anti-reflection coatings) to allow for maximum transmission of the laser light. Optics and optical coatings can be chipped, scratched, or smudged easily. Follow these simple guidelines when handling or cleaning the fiber ends:

- Always keep fiber connector covered with the protective cap when not in use
- Do not allow the end of the fiber optic cable to contact any surface, including your hands.
- When handling the fiber bundle, make sure that the end of fiber bundle does not get exposed to high temperatures; this may cause burn spots or potentially catastrophic damage to the fiber. This may also result from back-reflections when the lasers are turned on.
- When using an SMA connector, make sure that the connector does not rotate while it is being inserted into the bulkhead mount, this may cause damage to the fiber.
- Do not clean the fiber if there is no visible contamination.
- The end of the fiber optic cable constitutes an optical surface.
- Wear finger cots, or powder free surgical gloves, while handling fiber optic cables.
- Only fresh (dry) spectroscopic grade Methanol should be used as a cleaning solvent.
- Do not use Acetone as a cleaning solvent on the fiber optical surfaces. It will dissolve the epoxy resin which supports the fiber, and permanently destroy the optical transport fiber.

CONNECTING THE TRANSPORT FIBER TO THE LASER

1. Remove the red dust cap from the SMA-905 connector on the nose of the laser.
2. Keep the connector end clean by avoiding direct contact with hand or other materials.
3. Remove protective cap from transport fiber cable and *gently* insert into SMA-905 connection port.
4. DO NOT touch the end of the transport fiber cable.
5. Tighten the bolt on the fiber cable until finger tight (the metal covering of the transport fiber should not be able to move).
6. DO NOT leave transport fiber anywhere it could be harmed or easily broken.

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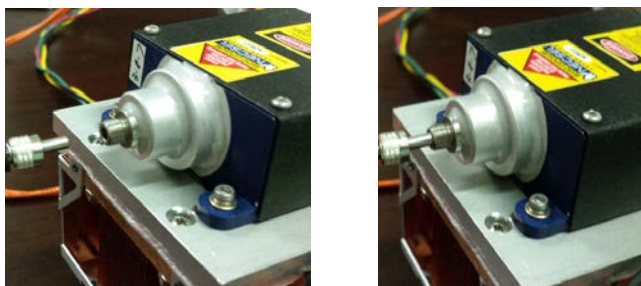


Figure 1: Inserting Transport Fiber

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CLEANING THE TRANSPORT FIBER

INTRODUCTION

The Necsel lasers can be mated to a variety of fiber configurations. Each laser typically has an industry standard SMA-905 fiber connector that allows for easy connection to individual fiber optic break-out legs that are combined into a common output ferrule at the other end. The output fiber arrangement may be in a variety of formats, but an example of one in a 16:9 rectangle format inside a round ferrule is shown in Figure B-12.

FIBER HANDLING

A dirty or damaged fiber can cause reduction in output power or permanent damage to the device. Each fiber end is highly polished with anti-reflection coatings to allow for maximum transmission of the visible light. Optics and optic coatings can be chipped, scratched, or smudged easily. Follow these simple guidelines when handling or cleaning the fiber ends:

- Keep fiber connector covered with the protective cap when not in use.
- Do not allow the end of the fiber optic cable to contact any surface, including your hands.
- When handling the fiber bundle, make sure that the end of fiber bundle does not get exposed to high temperatures; this may cause burn spots or potentially catastrophic damage to the fiber. This may also result from back-reflections when the lasers are turned on.
- When using an SMA connector, make sure that the connector does not rotate while it is being inserted into the bulkhead mount, this may cause damage to the fiber.
- Do not clean the fiber if there is no visible contamination.
- The end of the fiber optic cable constitutes an optical surface.
- Wear finger cots, or powder free surgical gloves, while handling fiber optic cables.
- Only fresh (dry) spectroscopic grade Methanol should be used as a cleaning solvent.
- Do not use Acetone as a cleaning solvent on the fiber optical surfaces. It will dissolve the epoxy resin which supports the fiber, and permanently destroy the optical transport fiber.

FIBER OPTIC CLEANING

Before performing the cleaning procedure, inspect the fiber optic surface with a fiberscope or magnifier to determine if the fiber end needs cleaning. Only perform the cleaning procedure if the fiber optic surface shows imperfections, otherwise the procedure may introduce dust, dirt, or potentially induce damage to the fiber optic. It is also recommended to screw on a fiber cap over the output of the laser to prevent any dust particles from entering – these will normally be shipped with the fiber.

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The "Drop and Drag" method is the least abrasive cleaning method and should always be used first to remove imperfections or smudges on the fiber optic surface. If the Drop and Drag method will not remove particulates or smudges, then the fiber optic surface should be cleaned with a cleanroom swab. The cleanroom swab is most effective; however, a folded lens tissue with a hemostat may be used as an alternative to the cleanroom swab.



Figure B-1. Optical Cleaning

The following materials are required to perform this procedure: (see Figure B-1.)

- Lens cleaning tissue.
- Cleanroom-quality swabs.
- Lens tissue and a hemostat may be used as an alternative to the swabs.
- Fresh spectroscopic-grade Methanol in drip or eye-dropper bottle.
- Fiber microscope (fiberscope) or magnifier lens is recommended.
- Latex (or equivalent) non-powdered, non-coated gloves or finger cots.

Important: Do not use Acetone! Acetone will dissolve adhesives used in the manufacture of the fiber optic bundle and will destroy the fiber optic cable. Always wear latex gloves or finger cots (or the equivalent) while performing any of the following procedures. Fingerprints, dust, condensation, and oils from bare hands can damage the fiber optic surface.

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Figure B-2. Methanol Drop on



Figure B-3. Wet Tissue Drag across Fiber

DROP AND DRAG PROCEDURE

Using a medicine dropper and a new, clean lens tissue, put one drop of Methanol near the center of the lens tissue. (See figure B-2)

1. Holding the fiber vertically so the fiber surface points up, carefully place the tissue so the optical surface rubs against the underside of the tissue.
2. In a single movement, gently drag the fiber surface against the underside of the wet tissue in a circle, spiraling out, taking care not to go over the same part of the tissue twice. Drag the fiber out from the saturated part of the tissue to the dry parts of the tissue, which dries the fiber optic surface and prevents Methanol residue. (See figure B-3).
3. Re-check the fiber with the fiberscope or magnifier. If the fiber surface looks clean, immediately install the fiber into the laser fiber-coupler, or place a plastic fiber cap over the end for later use.

If the imperfections have not been removed, or if any Methanol residue has been induced, continue with the cleanroom swab procedure below.

Methanol residue can cause burn spots or potentially catastrophic damage to the fiber optic or ferrule output end.

CLEANROOM SWAB PROCEDURE

Using lens tissue and a hemostat may be substituted for the cleanroom swab procedure. Reference the procedure titled **Folded Lens Tissue Procedure** for the alternate method.

1. Using a medicine dropper, put one to two drops of Methanol on the swab.
2. Vigorously shake off excess Methanol from the swab to prevent Methanol residue.

NOTE: Only the synthetic cloth should make contact with the fiber optic surface. Do not allow the plastic applicator to touch the fiber surface.

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1. Holding the fiber vertically so the fiber surface points up, carefully place the base of the swab against the fiber optic surface, taking care not to touch the plastic applicator to the fiber optic surface. (see figure B-4)
2. Drag the swab across the fiber optic surface in a single stroke. **Do not** drag the swab back and forth.
3. Repeat Step 2 using the other side of the swab.
4. Re-check the fiber with the fiberscope or magnifier. If the fiber surface looks clean, immediately install the fiber into the laser fiber-coupler, or place a plastic fiber cap over the end for later use.
5. If imperfections remain, repeat the procedure using a new swab.
6. If imperfections still remain, determine whether the fiber optic must be replaced. Contact Necsel service personnel if further guidance is needed.



Figure B-4. Swab w/ Methanol - Drag across

FOLDED LENS TISSUE PROCEDURE

As an alternative to the cleanroom swab procedure, use the following procedure with lens tissue and a hemostat:

1. With one hand on each end of the lens tissue, fold the tissue lengthwise in half, three times. Do not touch any part of the lens tissue that will make contact with the fiber optic surface.
2. Use a hemostat to fold the tissue in half, widthwise. Do not touch any part of the lens tissue that will be used to clean the fiber optic surface.
3. Attach a hemostat to the lens tissue.
4. Using a medicine dropper, put two drops of Methanol on the lens tissue.
5. Vigorously shake off excess Methanol from the folded tissue to prevent Methanol residue.



Figure B-5. Folded Lens Tissue



Figure B-6. Folded Lens Tissue

Only the lens tissue should make contact with the fiber optic surface. Do not allow the hemostat to touch the fiber surface.

6. Holding the fiber vertically so the lens surface points up, carefully place the base of the wet side of the folded tissue against the fiber optic surface, taking care not to touch the fiber optic with the hemostat.
7. Drag the folded tissue across the fiber optic surface in a single stroke. **Do not** drag the tissue back and forth.

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8. Repeat Step 7 using the other side of the folded tissue.
9. Re-check the fiber using the fiberscope. If imperfections remain, repeat the procedure using a new lens tissue. If the fiber surface looks clean, immediately install the fiber into the laser fiber-coupler, or place a plastic protective fiber cap over the end for later use.



Figure B-7. Hemostat Holding Lens



Figure B-8. Folded Lens Tissue

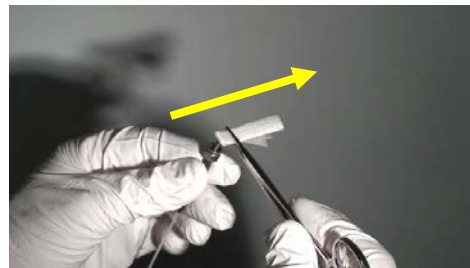


Figure B-9. Wet Folded Tissue



Figure B-10. Fiber Protective Cap

If the power output is acceptable, then the fiber can be used with little concern for damaging the assembly. However, if the power output is lower than it should be or not up to acceptable standards, the fiber must be considered damaged and must not be used. Similarly, if any burn marks are noted on the fiber ferrule, do not use it.

The following figures C-11 and C-12 are examples of good clean fiber tips. Both ends have broadband anti-reflection coatings in the visible from 400nm – 700nm.



Figure B-11. Fiber SMA Tip



Figure B-12. 27-Fiber Output Array

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