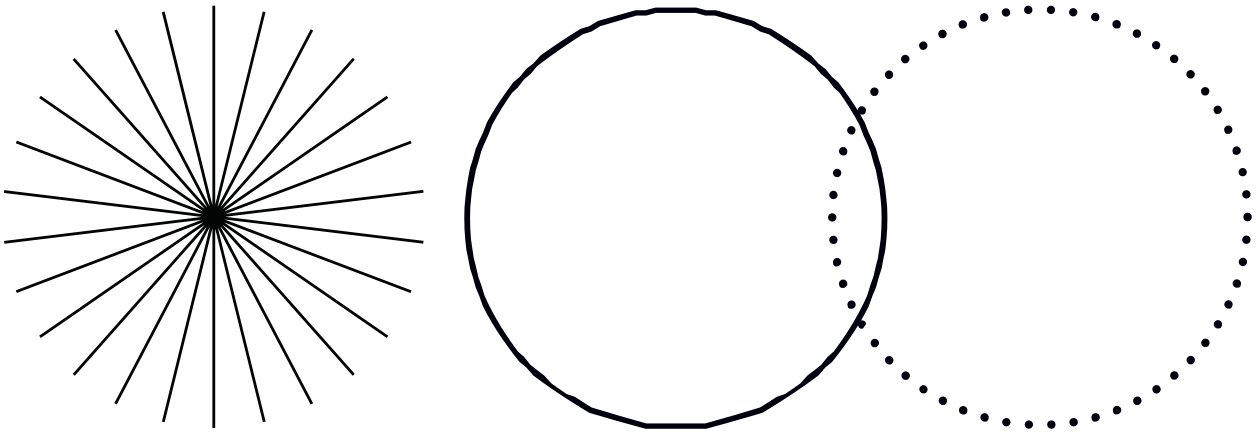
SureLock™ OEM Laser Diode Module

Operator's Manual



INNOVATIONS THAT RESONATE

COHERENT

Patents referenced in this manual are active when the manual is printed (see last page for the date). You are advised to check if the patents are still active www.coherent.com/legal/patents.
Every effort was made to make sure that the data shown in this document is accurate. The information, figures, tables, specifications, part numbers, and schematics contained in this manual are subject to change without notice. Coherent makes no warranty or representation, either expressed or implied, related to this document. In no event will Coherent be liable for any direct, indirect, special, incidental, or consequential damages caused by any defects in its documentation.

Technical Support
In the U.S.:
Should you experience any difficulties with your laser or need any technical information, please go to our web site www.Coherent.com. Should you need further assistance, please contact Coherent Technical Support by e-mail customer.support@coherent.com or telephone, +1-734-456-3100. Please be prepared to supply the model and laser head serial number of your laser system, the description of the problem, and any attempted corrective steps to the Product Support Engineer responding to your request. Telephone coverage is available Monday through Friday (except U.S. holidays and company shutdowns). Inquiries received outside of normal office hours will be captured by our automatic answering system and will be quickly returned the next business day.

Outside the U.S.:
If you are located outside the U.S., please visit www.Coherent.com for technical assistance, or contact your local Service Representative. Service Representative telephone numbers and addresses can be found on the Coherent web site.
Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that can occur at the same time with such services. Under no conditions do these support services affect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks defeated is always at the operator's own risk.

Table of Contents

1 Safety Precautions

This instruction manual explains how to use the OEM Butterfly Module.

Before use, please thoroughly read this manual. After reading, keep it together with the product for reference when necessary. Please retain packaging material in the event the unit is stored or shipped in the future.

CAUTION – ***Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. The body of the unit contains labels that specify the wavelength and maximum emitted power.***

WARNING! – ***To prevent permanent damage, observe these precautions:***

1. Protect against electrostatic discharge.
2. Take care in handling fiber. Inspect & clean fiber tip before connecting fiber. Warranty does not cover fiber tips and improper fiber handling.
3. Avoid external damage to the board and fiber.
4. Use supplied power supply or power supply meeting specifications.
5. Instrument is vibration sensitive. Handle with care. Permanent damage is possible.
6. Do not drop the module or operate it at extreme temperatures or humidity.

1.1 Explanation of Warning Symbols

This documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and ISO 7010.

Warning messages are intended to prevent accidents to operating personnel such as burns and electrical shocks.

1.2 Signal Words

Three signal words with color coded call-outs are used in this documentation:
WARNING!, **CAUTION**, and ***NOTICE***.

The signal words **WARNING** and **CAUTION** designate the degree or level of a hazard when there is a risk of user injury:

WARNING!
Indicates a hazardous situation that, if not avoided, could result in serious injury to eyes and / or skin.

CAUTION
Indicates a hazardous situation that, if not avoided, could result in minor to moderate injury to eyes and/or skin.

The signal word **NOTICE** is used when there is the risk of product or property damage:

NOTICE
Indicates information important to take special note of, but is not hazard-related.

1.3 Symbols

The signal words **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level:

This symbol is intended to alert the operator to the presence of highly-important operating and maintenance instructions.

This symbol is intended to alert the operator to the danger of exposure to hazardous visible and invisible laser radiation.

This symbol is intended to alert the operator to the danger of Electro-Static Discharge (ESD) susceptibility.

This symbol is intended to alert the operator to the presence of additional important information.

2 Features

- Compact footprint - only slightly larger than the 14-pin butterfly laser
- High optical power - greater than 600mW diodes available
- Narrow spectral bandwidth – <0.15nm (<2cm-1), typically 0.07nm (1.2cm-1)
- Wavelength stability across operating range < 0.01 nm / hour (<0.17cm-1)
- Fiber coupled output – Typical: 105 mm core multimode fiber.

3 Specifications

OPTICAL	
Power Output - P_o	Diode dependent. Standard 600mW. Custom output power setting available
Center Wavelength in vacuum - L_p (nm)	Minimum: 784.5 Typical: 785 Maximum: 785.5 Other wavelengths include 638, 808, 830, 976, 1064.
Spectral bandwidth - Δλ (nm)	Typical: 0.07 (1.2cm-1) Maximum: 0.15 (2cm-1)
Fiber Type	Configuration Dependent. Typically 105 µm core/ 900 µm tubing
Connector	FC/PC
Numerical Aperture - NA	0.22
Free Space Beam	Typ: 1 mm X 0.2 mm, divergence 25 X 5 milliradians
ELECTRICAL AND THERMAL	
Maximum Current – Imax (A)	3
Operating Voltage – Vop (V)	5
Operating Temperature – Top (°C)[1]	Minimum: 0 Typical: 25 Maximum: 40
Storage Temperature – TS (°C)[1]	Minimum: -20 Maximum: 80
MECHANICAL	
Board Dimensions	100 mm x 40 mm x 35 mm
Weight	125 g

1. Non-condensing.

*All specifications are at rated power with a case temperature of 25°C unless otherwise noted.

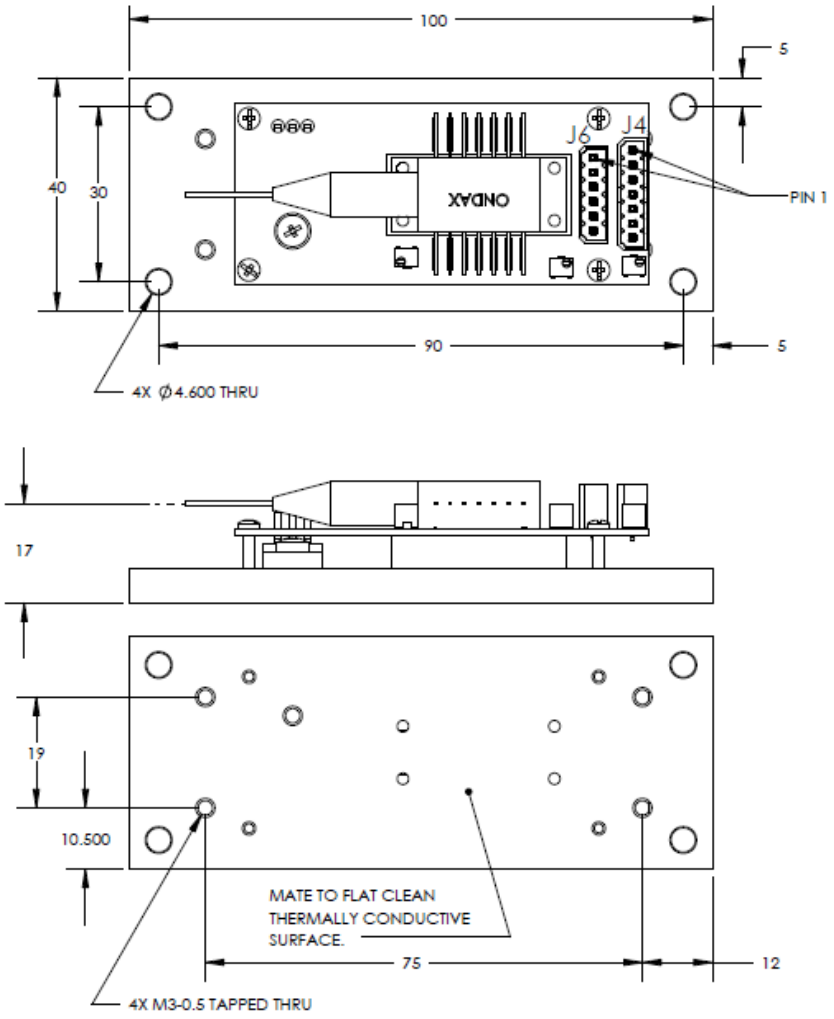


Figure 1: Mechanical Dimensions

	Pinout – J4[1]		Pinout – J6[2]
Pin	Description	Pin	Description
1	Interlock (open circuit: laser off, close circuit; laser on with 10-40 second delay)	1	4.9V – 5.25 VDC
2	Interlock (open circuit: laser off, close circuit; laser on with 20-40 second delay)	2	Power GND
3	TTL+ (0-1.5V laser OFF, 3.5-5V laser ON)	3	Laser emission indicator voltage out (5V, 50-100mA output)
4	TTL GND	4	Laser emission indicator GND
5	Analog voltage output setpoint, corresponding to MAX laser power (current). Factory default typically 600mW or as specified in order configuration	5	N/A
6	Analog voltage input for power control. VALUES SHOULD REMAIN BETWEEN PIN 5 and PIN 7 SETPOINTS. Voltage is referenced to Power GND (AGND)	6	N/A
7	Analog voltage output setpoint, corresponding to MIN laser power (current). Factory default 0.2mW-0.4mW or as specified in order configuration		
	Male Mating Connector: Phoenix Contac 1778887		Male Mating Connector: Phoenix Contac 1778874

Figure 2: Connections

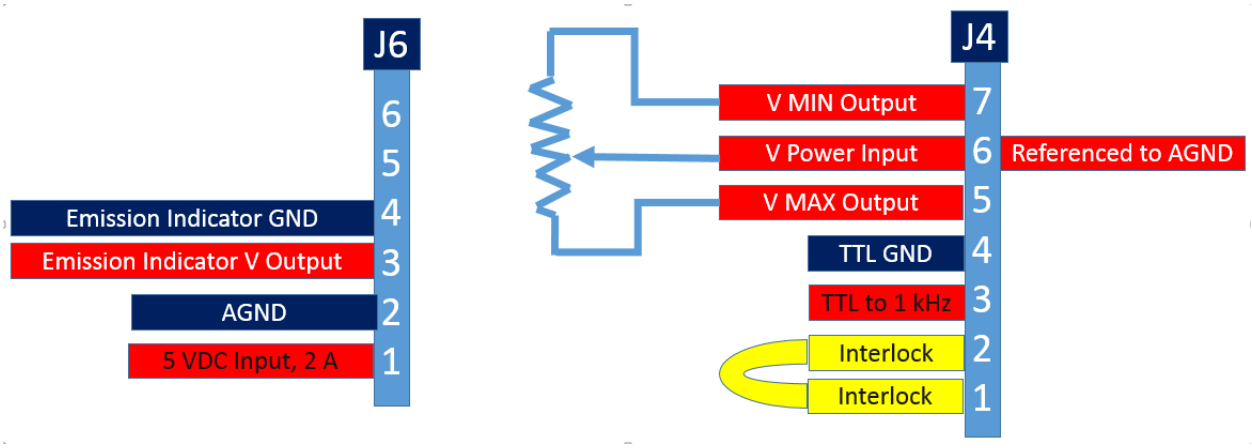


Figure 3: With Supplied 10k Potentiometer in Circuit for Power Control. LED Emission indicator not included

4 Operating Procedures

4.1 J6 Molex Connector:

- Apply specified DC voltage across pins 1 and 2 to power the laser. Flying leads to both are provided.
- Pins 3 and 4 can be used with an LED as an indicator that laser emission is on (emission indicator). **LED not included.**

4.2 J4 Molex Connector:

- Pins 1 and 2 are interlock pins that turn the laser OFF in an open circuit, and in a closed-circuit configuration the laser will turned ON with a delay. By default, they are wired in a closed-circuit configuration. Closed circuit configuration is required for laser to emit radiation under all circumstance.
- Pins 3 and 4 are used for TTL signal to operate the butterfly laser in a Pulse Width Modulation (PWM) configuration or for immediate laser on/off without timed delay. Potential difference of 0-1.5 V triggers laser OFF, 3.5 – 5 V triggers the laser ON. Default configuration of no connection operates laser in CW configuration. Common usage mode for this would be PWM or complete and immediate on/off control of laser emission (i.e. a Raman background measurement)
- Pins 5 and 7 output voltage values corresponding to the maximum current and minimum operating current (i.e. power) setpoints of the laser. These are factory set to typical output power values of 600mW and 0.2 mW respectively, but can be set to different values if needed. Please contact the factory if you desire other max/min set points.
- Pin 6 is analog voltage input for varying laser diode current which results in optical power changes. The maximum voltage input for pin 6 should never exceed voltage of pin 5 since the voltage of pin 5 represents the maximum laser diode current. With factory default settings, the voltage of pin 7 represents laser diode threshold current and may be used as a reference for voltage level of when laser emission begins.

The supplied connector includes an attached mechanical dial potentiometer as an illustration of the interaction of pin 5, 6, and 7. An example chart is included below to illustrate the relationship between pin 5, 6 and 7 as supplied.

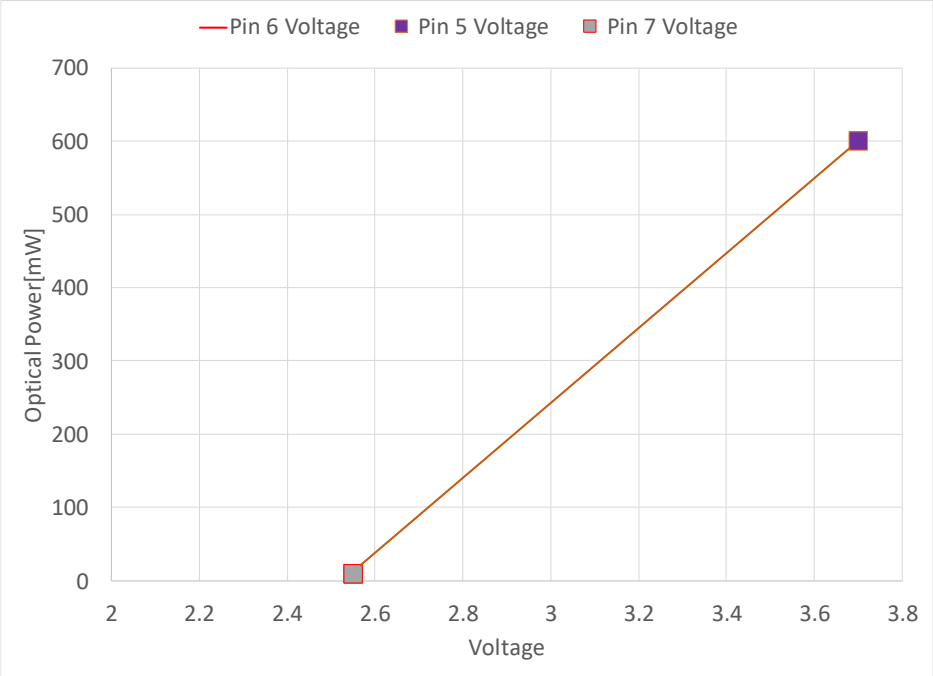


Figure 2: Example Pin 5,6,7 Voltage vs Optical Power (note: indicated values are arbitrary and should not be considered as reference)

The signal pin of the potentiometer is attached to pin 6 while pin 5 and 7 are attached to voltage inputs of the potentiometer. Varying the potentiometer wiper would vary the optical power from maximum to minimum current as defined by pin 5 and 7 voltages. Note that the included example potentiometer cannot lower laser diode current below value of pin 7; hence, there is residue ASE light at its lowest setting. TTL line could be used to completely disable laser emission. Alternatively, instead of using pin 7 as one of the voltage references, the ground pin could be connected to the potentiometer. This would lower the minimum laser diode current available by adjustment of the potentiometer at the cost of reducing the dynamic range of optical power because a portion of wiper blade would be operating in the region below threshold current.

- Lowering the power level below 70 mW may cause poor optical isolation reducing the Side Mode Suppression ratio from the nominal value of 40 dB.

5 Troubleshooting and Maintenance

5.1 Inspection

If the unit appears to be operating incorrectly or with low output power, check the following:

- Verify power supply voltage and current.
- Visually inspect board for scratches, dings, dents, or other signs of damage due to handling.
- Verify power source connections to the laser module. (Make sure you provide 5 Volt 3 Amp supply across pins 1 and 2 of the J6 Molex connector)
- Verify interlock connection.
- Turn knob connected to Pin 6 of J4 to see if that raises the power output.
- Ensure that the operating environment is within specifications.

- Verify cleanliness of the fiber tip

If any problems with the laser output are detected which could not be solved with the above steps, please contact Coherent at service.monrovia@coherent.com prior to performing further troubleshooting on the system. Please note all symptoms when requesting service access to the system. Only open the system if instructed by Coherent technical support.

5.2 Maintenance

Routine maintenance is not required

6 Service

6.1 Repair

If the module fails during use, please check the items in section 5.1 before requesting an RMA.

Defective modules will be repaired at cost, if possible. An RMA must be requested before sending it to Coherent. When shipping, please use original packaging materials, or a box at least five times as large as the module with enough packaging material to prevent any movement of the module within the box.

6.2 For Information or Enquiries

If you need information regarding purchase or repair, or for any other Sales related questions, please contact Coherent directly (see 6.4) or the distributor from whom the module was purchased.

6.3 Coherent Limited Warranty

Coherent warrants that all SureBlock™ TR-Probe THz-Raman systems will be free from defects in material and workmanship for 12 months from the date of shipment. This limited warranty covers only those defects that arise as a result of normal use of the product, and does not cover any other problems, including those that arise as a result of: (i) improper handling, maintenance or modification, (ii) operation outside the product's specifications; or (iii) unauthorized modification or misuse.

If Coherent receives, during the applicable warranty period, notice of a defect in any product which is covered by this warranty, Coherent shall either repair or replace the product, at Coherent's option. Coherent shall have no obligation to repair, replace or refund until the customer returns the defective product to Coherent. Any replacement product may be either new or like-new, provided that it has functionality at least equal to that of the product being replaced. Coherent products may contain remanufactured parts, components, or materials equivalent to new in performance.

Responsibilities of the Buyer

The Buyer is responsible for providing the appropriate utilities and an operating environment as outlined in the product literature. Damage to the system caused by failure of Buyer's utilities or failure to maintain an appropriate operating environment, is solely the responsibility of the Buyer and is specifically excluded from any warranty, warranty extension, or service agreement.

The Buyer is responsible for prompt notification to Coherent of any claims made under warranty. In no event will Coherent be responsible for warranty claims made later than seven (7) days after the expiration of warranty.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from any of the following conditions:

- Components and accessories manufactured by companies other than Coherent, which have separate warranties
- Improper or inadequate maintenance by the Buyer
- Buyer-supplied interfacing
- Operation outside the environmental specifications of the product
- Unauthorized modification or misuse
- Improper site preparation and maintenance
- Opening the housing
- Fiber tip and fiber damage due to mishandling and cleaniness

Coherent assumes no responsibility for customer-supplied material. The obligations of Coherent are limited to repairing or replacing, without charge, equipment that proves to be defective during the warranty period. Replacement sub-assemblies may contain reconditioned parts. Repaired or replaced parts are warranted for the duration of the original warranty period only. The warranty on parts purchased after expiration of system warranty is ninety (90) days.

This warranty does not cover damage due to misuse, negligence, or accidents; or damage due to installations, repairs or adjustments not authorized specifically by Coherent.

This warranty applies only to the original purchaser at the initial installation point in the country of purchase, unless otherwise specified in the sales contract. The warranty is transferable to another location or to another customer only by special agreement, which will include additional inspection or installation at the new site. Coherent disclaims any responsibility to provide product warranty, technical or service support to a customer that acquires products from someone other than Coherent or an authorized representative.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, AND DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL LOSS. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

6.4 Contacting Coherent

Coherent, Inc.
850 E. Duarte Rd.
Monrovia, CA 91016
Tel: 626-357-9600
Fax: 626-357-9321
Web: http://www.coherent.com
Email: customer.support@coherent.com
Technical Support: service.monrovia@coherent.com

7 Appendix

7.1 Importance Of Maintaining Clean Fiber-Connections

To ensure optimal performance of the laser system, it is crucial to maintain a pristine FC/PC connector on the unit and at the tips of the delivery fiber. Any contamination on the ends of the fiber connections can lead to undesirable performance outcomes and, if not addressed, may ultimately result in the failure of components or the entire system. There are also less apparent or even invisible contaminants that can cause unwanted attenuation, optical noise, or subpar performance. Examples include oils (e.g., from fingerprints), film coatings (e.g., condensates from vapors in a test chamber), and other residues (e.g., after the evaporation of water or solvents, dust, etc.). Furthermore, the laser output intensity at the very end of a fiber tip is so high that an small contaminant can be burned onto the end if it obstructs the core during operation at higher powers. This burn can damage the optical surface to the extent that it cannot be adequately cleaned, necessitating the replacement of the delivery fiber.

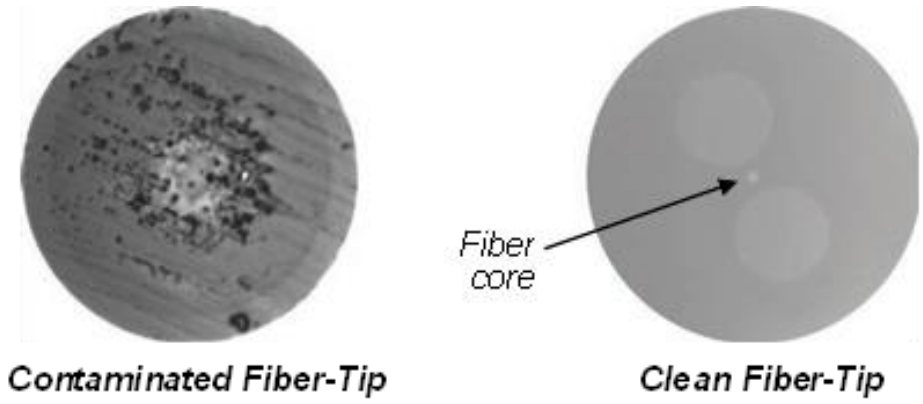


Figure 9.1-1: Contrast between a contaminated and clean Fiber-tip, as-viewed under magnification

NOTICE *- When cleaning fiber components, always complete the steps carefully, and wear nitrile gloves when handling fiber-ends. NEVER touch the fiber end-face with bare fingertips, even if "clean". The goal is to remove all dust and contamination to provide the cleanest mating surfaces possible for the optical connections. Remember that inspection, cleaning and re-inspection are very important steps which must be done before you make any fiber connections.*

WARNING! *– Always turn the unit OFF before you inspect a connected-fiber tip and/or clean the unit FC/PC connector:*

Never look into a fiber-end or the output aperture , while the Laser Enable keyswitch is in the ON position, even if the 'E-Stop' and/or other safety-interlocks are open and laser emission is not occurring.

Never attempt to inspect a fiber-end with a fiberscope while the laser is ON or operating.

Never use the eyes to verify laser emission, gauge power levels, or evaluate fiber-tip cleanliness' once the laser is ON and operating.

7.2 Cleaning the Fiber Connector

NOTE- The product recommendations presented here are provided for convenience and reference purposes only. Coherent explicitly disclaims any responsibility or implication of warranty or guarantee regarding the performance, durability, or availability of these products. Moreover, the instructions given herein are intended as general guidelines and should not be considered exhaustive or comprehensive. It is important to note that fiber-cleaning methods and recommendations may vary between manufacturers and tools. As Coherent cannot dictate the choice of cleaning products or tools a customer may select, it is strongly advised to carefully adhere to the fiber tip cleaning instructions outlined in the User Manual for each specific product.

Coherent recommends use of either the US Conec IBC™ Brand Model 9392 (or, alternatively, Model M250) 'one-click' style FC/PC connector-cleaners each time before freshly-mating a new delivery-fiber to the unit

Figure 9.2-1: US Conec IBC™ Brand Model 9392 and M250 FC-connector cleaning tools

NOTICE- No known cleaning method is absolutely 100% effective. Thus, it is imperative that inspection is included as an 'integral part' of your cleaning process and protocol. Incorrect cleaning can damage the fiber, and/or the laser internally.

7.3 Inspecting And Cleaning Delivery-Fiber Ends

Inspection of delivery-fiber ends are done with either a desktop video-fiberscope or a hand-held fiberscope. Both tools are specialized microscopes used for inspecting optical fibers. Any scope chosen should provide

at least 200x total magnification. ***Specific adapters may be needed for FC/PC connectors*** to properly inspect the Fiber-tip. Figure 9.3-1 provides examples of popular scopes.

Handheld Fiber-Optic Inspection Scope

Desktop Video-Microscope Fiber Inspection Scope

Fiber-Optic Inspection-Scope Adapters

E-2000 Service Adapter 1019034 to hold spring loaded cap open

Figure 9.3-1: Examples of Fiber-tip inspection scopes and tools

To inspect a delivery-fiber tip:

1. Make certain that the laser is turned OFF before starting inspection.
2. Put the applicable inspection adapter or probe on your equipment.
3. Unscrew and remove the delivery-fibers' dust cap.
4. Insert the delivery-fiber connector into the fiberscope adapter and adjust the focus ring until you see a clear fiber tip image.
5. Clean the fiber tip and re-inspect, as necessary. See below for an overview on fiber tip cleaning.
6. Immediately plug the clean connector into the connector it will be mating-to decrease the risk of re-contamination.

Dry Cleaning Technique

The recommended dry-cleaning technique utilizes a 'cartridge' cleaning tool. Coherent recommends use of the following cartridge cleaning tools and associated techniques. (source-websites, valid as-of the time of this writing).

Figure 9.3-2 shows examples of these tools

OPTIPOP R, P/N ATC-RE-02
-
http://www.ntt-at.com/product/optipop/

CLETOP-S TYPE A, P/N 14110501
-
http://www.cletop.com/html/products.html

Figure 9.3-2: Examples of recommended Cartridge Fiber-tip cleaning tools

NOTE-Since fiber-cleaning techniques and advice can vary from manufacturer-to-manufacturer (and tool-tool), and Coherent cannot 'control' what cleaning product or tool a customer may choose to purchase, it is simply recommended to closely follow the Fiber-tip cleaning instructions provided in each products' User Manual.

Wet Cleaning Technique

1. Make certain that the laser is turned OFF before starting cleaning.
2. Carefully remove the delivery-fibers' dust cap.
3. Inspect the fiber-tips with a fiberscope. (See Figure 9.2-1, above)
4. If a tip is dirty, clean with a cartridge cleaner, as-per the manufacturer's instructions – or – follow a simple 'Wet-to-Dry wipe' technique, as-follows: (Also see Figure 9.3-3, below)

CAUTION – ***Follow all safety instructions when using isopropyl alcohol and/or methanol (used for wet cleaning of the fiber tip). If you do not have a copy of the safety instructions and MSDS sheets for using IPA or methanol, contact your Industrial Safety Dept. before following the cleaning information described in this document.***

1. Start with a fresh sheet of lint-free, optical-grade lens paper, folded 3 times, to yield a cleaning surface with '8 layers' of folded material. Be
2. careful not to touch or contaminate this cleaning 'pad'.
3. Carefully drop spectroscopic-grade isopropyl alcohol ('IPA') or methanol onto the pad, until the 'wet area' is approximately the size of a penny.
4. Ensure that an area of the cleaning pad remains dry.
5. Place the 'pad' just created on a clean, smooth work-surface, and bring the fiber tip to a perpendicular-angle to the pad, and lightly contact it against the surface of the pad.

6. With very light pressure, and holding the tip to the cloth, 'wipe' the fiber tip lightly across the Wet area of the pad, using a 'scalloped Figure 8' motion. Do Not 'scrub' back and forth! At the same time, gently rotate the fiber-tip 90 – 180 degrees, maximum.
7. Immediately repeat this same action on a clean, dry-section of the pad to remove any traces of solvent. Again, Do Not 'scrub' back and forth!

NOTICE ***- Improper 'Wet' techniques can complicate fiber tip cleaning and should only be used when all dry, 'cartridge-tool based' techniques have failed to clean the tip sufficiently. The primary concern with using solvents is if it is not removed completely from the tip, residual liquid acts as a transport mechanism for loose debris elsewhere on the end-face. If the solvent is simply allowed to evaporate slowly off the end, it can leave residual contaminant on the fiber core. This is extremely difficult to clean off without another Wet cleaning and usually more difficult to remove than the original contaminant. Excess solvent can also remain in tiny 'surface-pits' where it can re-emerge upon fiber connection.***

Additionally, 'scrubbing' the fiber back-and-forth on the pad or wiping over the same area more than once can re-contaminate or damage the Fiber-tip.

(See technique-steps illustrated in Figure 9.3-3, next-page)

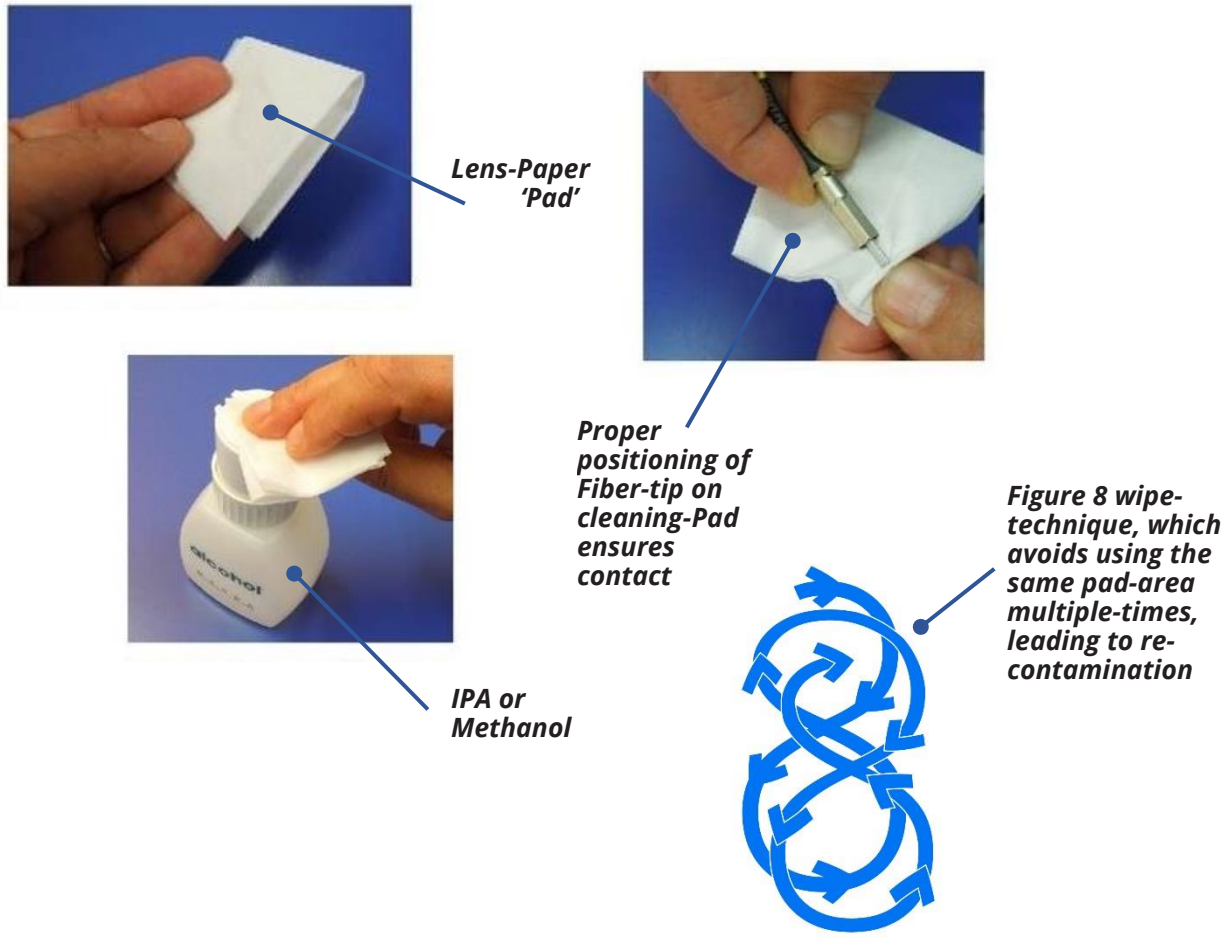


Figure 9.3-3: 'Figure 8' Wet-cleaning a fiber-tip with a 'cleaning pad' made from optical-grade lens paper.

Summary:

1. Inspect the delivery-fiber tip with a fiberscope or microscope, as per the instructions above. If the tip is dirty, use the Dry-cleaning technique to clean it, as-per the instructions above.
2. Re-inspect the fiber tip. If the connector is still dirty, repeat the Dry-cleaning technique, as-per above, a second time.
3. Re-inspect the fiber tip again. If the connector is *still* contaminated, clean it with the Wet cleaning technique, as per the instructions above.
4. Re-inspect the fiber tip again. If the contaminate is still present, repeat the Wet cleaning process, as per above, until the fiber tip is clean.

If the delivery-fiber tip is *still* contaminated after several cleaning attempts using both the Dry and Wet cleaning techniques, contact your technical support

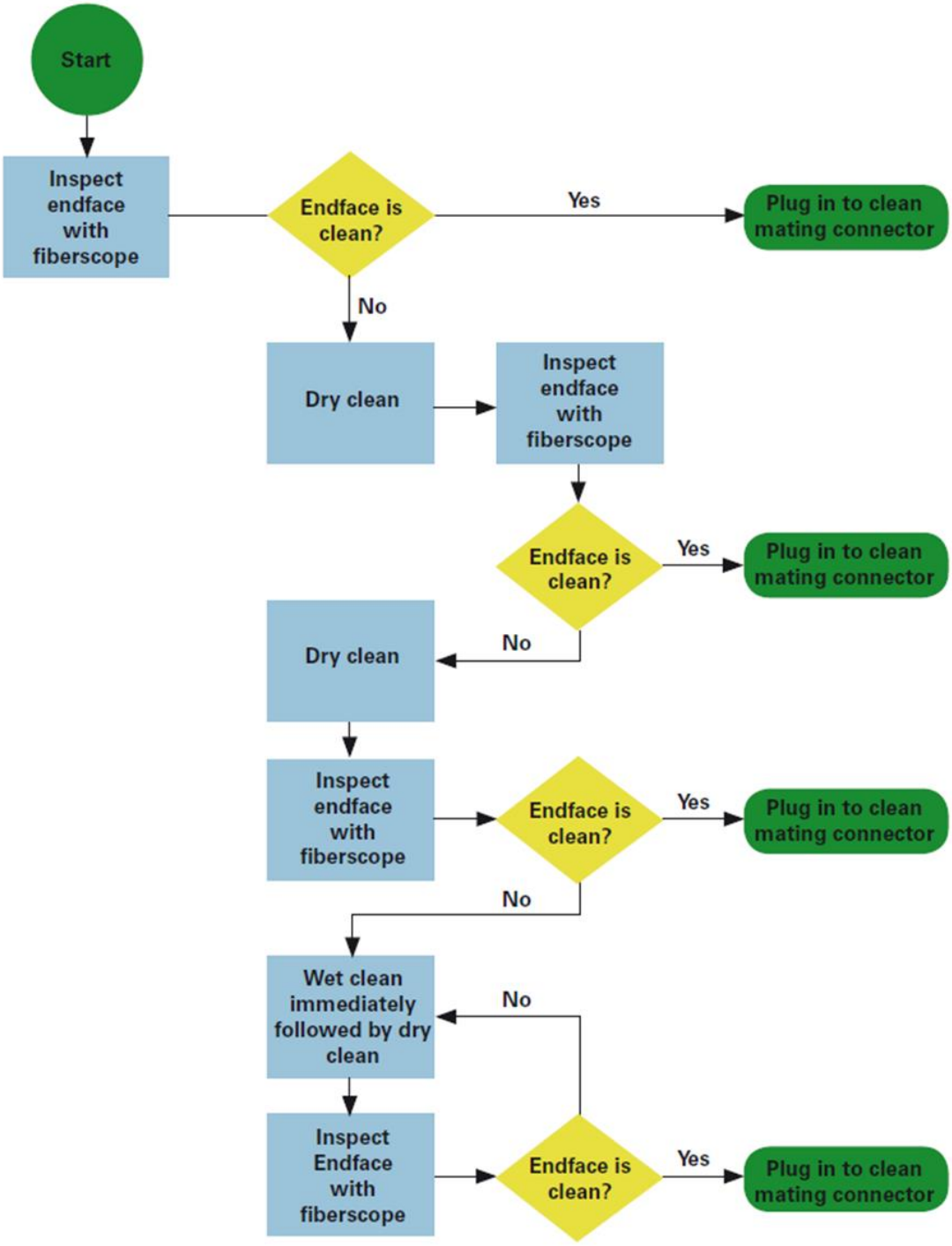


Figure 9.3-4: An example of a fiber cleaning process flow

COHERENT

INNOVATIONS THAT RESONATE

SureLock™ OEM Laser Diode Module Operator's Manual

Part No. 115-80060-002 Rev. 8 16 February 2024