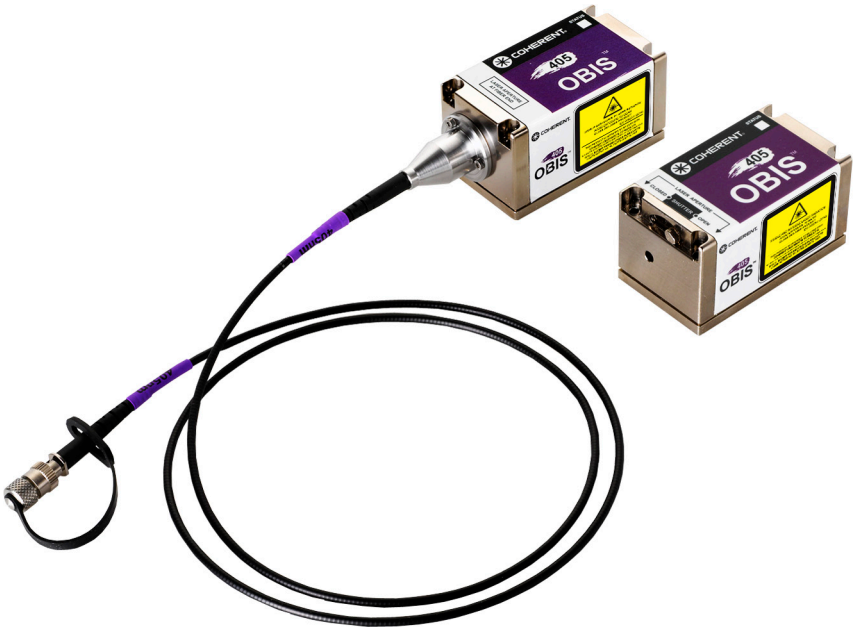
OBIS LX/LS Lasers Description & Operation Part 1 of 3

Operator's Manual



COHERENT®
Superior Reliability & Performance

Operator's Manual
OBIS LX/LS Lasers
Part 1 of 3 - Description & Operation

COHERENT®

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USA

Patents referenced in this manual are active as of the date this manual is printed. For a list of current patents, see www.coherent.com/patent.

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See "Appendix - Service & Support" (p. 201) for more information and detailed instructions.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 PREFACE

The Operator's Manual presents the following information for OBIS LX and OBIS LS laser systems:

- **Part I** — Description of the laser, installation instructions, operations, and information related directly to the laser module
- **Part II** — Descriptions of the components, controllers, and accessories for the OBIS LX/LS laser systems
- **Part III** — Supporting information about the interface protocol and host commands for OBIS LX/LS laser systems

NOTE: Information about the Coherent OBIS LG laser is ***not*** included in this manual. For information about that product, refer to the *OBIS LG Operator's Manual* (P/N 1263430).

WARNING!
Use all controls, adjustments, and procedures as specified in this manual. Failure to do so can cause dangerous radiation exposure.The user information reported in this manual is in compliance with the following standards for Light-Emitting Products EN/IEC 60825-1 *'Safety of laser products – Part 1: Equipment classification and requirements'* 21 CFR Title 21 Chapter 1, Sub-chapter J, Part 1040 *'Performance standards for light-emitting products'*.

1.1 Safety Warnings

Anyone setting up or operating an OBIS laser must first read and understand safety information prior to beginning any tasks.

CAUTION!
Read this manual before operating the laser for the first time. Pay special attention to the material in "Appendix - Laser Safety" , which describes the safety features of the laser.

This section provides information about signal words and safety symbols that to know before work is begun. Safety instructions are provided in appendix "Appendix - Laser Safety" (p. 125).

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.

1.1.1 Signal Words

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and **NOTICE**. These signal words designate the degree or level of hazard when there is the risk of injury, as described in Table 1-1:

Table 1-1. Signal Words

Signal Word	Description
DANGER	Indicates a hazardous situation that, if not avoided, WILL result in ***death or serious injury***. This signal word is to be limited to the most extreme situations.
WARNING	Indicates a hazardous situation that, if not avoided, COULD result in ***death or serious injury***.
CAUTION	Indicates a hazardous situation that, if not avoided, COULD result in ***minor or moderate injury***.
NOTICE	Indicates information considered important, but not hazard-related. The signal word "NOTICE" is used when there is the ***risk of property damage***.

Messages relating to hazards that could result in both personal injury and property damage are considered safety messages and not property damage messages.

1.1.2 Symbols

The following signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and **NOTICE**.

These signal words designate the degree or level of hazard when there is the risk of injury, as described

These signal words designate the degree or level of hazard when there is the risk of injury, as described in Table 1-2:

Table 1-2. Safety Symbols

Icon	Alerts the operator to…
	Important notes or instructions for operation and maintenance.
	Danger of exposure to hazardous visible and invisible laser radiation.
	Danger of susceptibility to Electro-Static Discharge (ESD).
	Dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

1.2 Export Control Laws

It is the policy of Coherent® to comply strictly with export control laws of the United States of America (USA).

Export and re-export of lasers manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations (ITAR).

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by laws in the USA, clarification must be obtained from Coherent or an appropriate agency of the U.S. Government.

For products manufactured in the European Union, Singapore, Malaysia, Thailand: These commodities, technology, or software are subject to local export regulations and local laws. Diversion contrary to local law is prohibited. The use, sale, re-export, or re-transfer directly or indirectly in any prohibited activities are strictly prohibited.

Declaration of Conformity certificates are available upon request.

1.3 Receiving and Inspection

Inspect all shipping boxes for any indication of damage, and then document these discrepancies on the packing list. If damage is seen, immediately contact the shipping carrier. Also contact either the Coherent Order Administration Department at 1.800.367.7890 (outside the U.S.: 1.408.764.4557) or an authorized Coherent representative. See "Appendix - Parts & Accessories" (p. 155) for a list of parts shipped with each system.

NOTICE

After unpacking the system, save the shipping boxes for potential later shipments—refer to "Appendix - Laser Repacking Procedure" (p. 191) for repacking instructions.

2 DESCRIPTION AND SPECIFICATION

This section provides information about the OBIS laser system, including:

- Components and accessories overview (p. 7)
- Description of features (p. 5)
- OBIS LX functional block diagram (p. 17)
- OBIS LS functional block diagram (p. 19)
- Heatsink (optional) (p. 24)
- Power supply for OBIS Laser or OBIS Remote (p. 26)
- OBIS Remote (p. 28)

2.1 Components and Accessories

Figure 2-1 shows the components and accessories for the OBIS laser system:

Figure 2-1. OBIS Laser System Components and Accessories

Table 2-1 lists the name and part number for components and accessories in the OBIS Laser System. For additional accessories and part numbers, refer to "Appendix - Parts & Accessories" .

Table 2-1. OBIS Laser System Components and Accessories

Item	Description
1	OBIS LX/LS Laser
2	Laser mounting bolts/washers (M3 x 35 mm / 5 mm O.D., 4 each - included with laser)
3	OBIS Remote (Single Laser) with keys (two each) and interlock
4	Wavelength labels for OBIS Remote (part of accessory pack)
5	Power supply, 110/220V AC, 12V DC, IEC-320
6	Power Cord, SVT Jacket, 125VAC, 10A, NEMA 5-15P TO IEC-60320-C13
7	USB cable, Type A to Type Mini-B (1.8 meters)
8	Cable, SDR, laser to OBIS Remote (1 meter) Optional 0.3 meter and 3 meter cables sold separately—see "Appendix - Parts & Accessories" (p. 155)
9	Mounting brackets/hardware for OBIS Remote
10	Interlock, shorted, for OBIS Remote (part of accessory pack)
11	*OBIS Laser Safety and Installation Quick Start Guide*
	OBIS LX/LS Operator's Manual (Not shown; on the Coherent website)

Coherent product information and related software is available in one easily accessible location on the Coherent website. To download the current software, as well as a a copy of the complete *OBIS LX/LS Operator's Manual* (P/N 2283534), go to:

https://www.coherent.com/resources

Table 2-2 lists other products that support the OBIS laser system. For more information, see "Appendix - Parts & Accessories" (p. 155).

Table 2-2. Supporting OBIS Products

		
6-LASER REMOTE		**LASER BOX**
		
SCIENTIFIC REMOTE		**GALAXY BEAM COMBINER**

2.2 Description

OBIS LX (Direct Diode) and OBIS LS (OPSL) laser products come with many accessories to support application needs.

The OBIS Single Laser (1-Laser) Remote for OBIS LX/LS offers all the features from the laser in a convenient CDRH-compliant interface.

As with all OBIS LX/LS lasers, the laser itself is a stand-alone all-in-one laser solution. The OBIS Laser comes with a Power In connector, USB connector, Fan connector, and a SDR (Shrunk Delta Ribbon) connector for laser control I/O. All of these connectors are on the back panel of all OBIS LX/LS laser.

OBIS fiber-pigtailed lasers provide the simplicity of a plug-and-play platform, utilizing a wide range of wavelengths from the near ultra-violet (near UV) to the near infrared. Fiber termination is complete with a FC/APC connector.

These lasers achieve superior performance and reliability with hands-free operation. OBIS FP lasers combine single-mode polarization-maintaining fiber with an FC/APC connector for a high-quality, low-noise laser beam

output. OBIS FP lasers also utilize proprietary fiber technology to provide superior lifetimes and a permanent fiber attachment for a guaranteed power over time.

NOTICE

Use only Coherent approved SDR type cables for OBIS LX/LS lasers. DO NOT use Camera Link™ (SDR) or SDR-type cable assemblies from other vendors.

To simplify integration, the OBIS Single Laser Remote connects to the single SDR-type connector for power, signals, and communication. The OBIS Single Laser Remote then brings all of these features to the controls and connectors on the front and back panels of the Remote.

OBIS Single Laser Remotes can be stacked together with the supplied mounting hardware for applications using several OBIS LX/LS lasers, as shown in Figure 2-2.

Figure 2-2. Stack OBIS Remotes

For details about specific product performance, refer to the OBIS Data Sheet. Coherent product information and related software is now available in one easily accessible location on the Coherent website. Filter searches by product type, document category, or both. To download manuals and software, go to:

https://www.coherent.com/resources

2.2.1 System Features

The following features are offered by the OBIS laser system.

- Single transverse mode
- Thermal stability for increased life and performance
- Compact package
- High-quality glass optics

- Circular beams
- RS-232 and USB communication
- Mechanical beam shutter or detachable protective cap (FP versions only)
- OBIS Remote for regulatory compliance (optional)
- Heatsink (optional)

In addition, Coherent Connection software is available to control one or more OBIS LX/LS lasers.

The laser (either free-space or fiber pigtailed) is the base module for the OBIS Laser System and can be used stand-alone or with an OBIS Remote.

NOTICE

The shutter for the OBIS is included in the laser. The shutter for the OBIS FP is the fiber end cap.

Operating the laser without the OBIS Remote is NOT CDRH compliant. The user takes all responsibility for safety and correct compliance to CDRH 21 CFR 1040 and IEC60825-1.

CAUTION!

To be CDRH compliant, an OBIS Remote *must* be used with the laser—the laser alone is *not* CDRH compliant.

CDRH-compliant installation and operation require only the SDR connection to the OBIS Remote. **DO NOT** use the USB and power supply connections on the laser when the OBIS Remote is connected.

2.2.2 Laser Front Panel

The OBIS Laser front panel (Figure 2-3) includes the laser beam aperture and the shutter control.

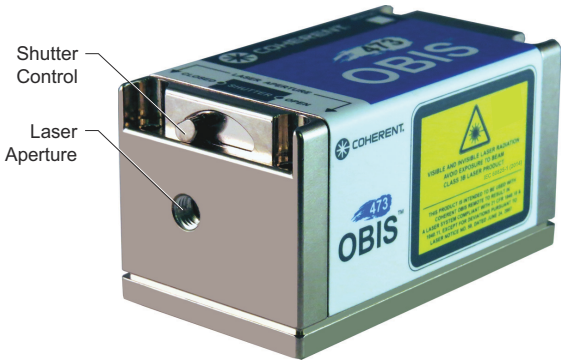


Figure 2-3. OBIS Laser Front Panel

Figure 2-4 shows the shutter in the Open and Closed position.

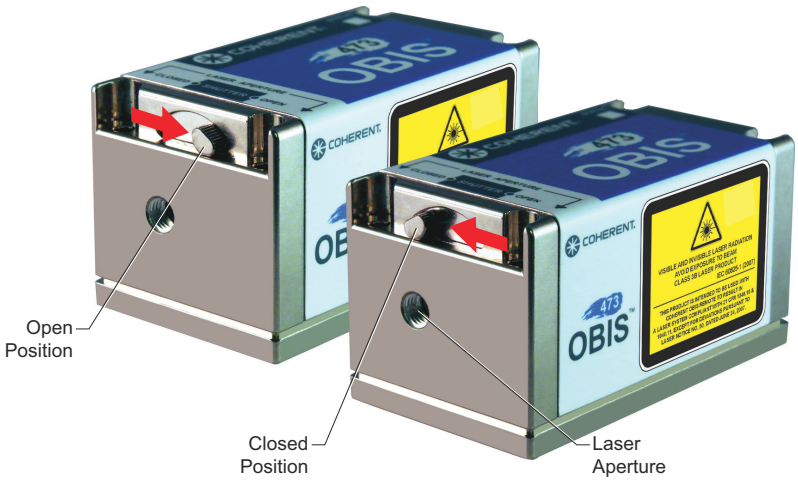


Figure 2-4. OBIS Laser Shutter in Open and Closed Positions

The OBIS fiber-pigtailed laser front panel, shown in Figure 2-5, includes a metal shutter cap.

NOTICE!
DO NOT adjust the fiber strain relief bolts!

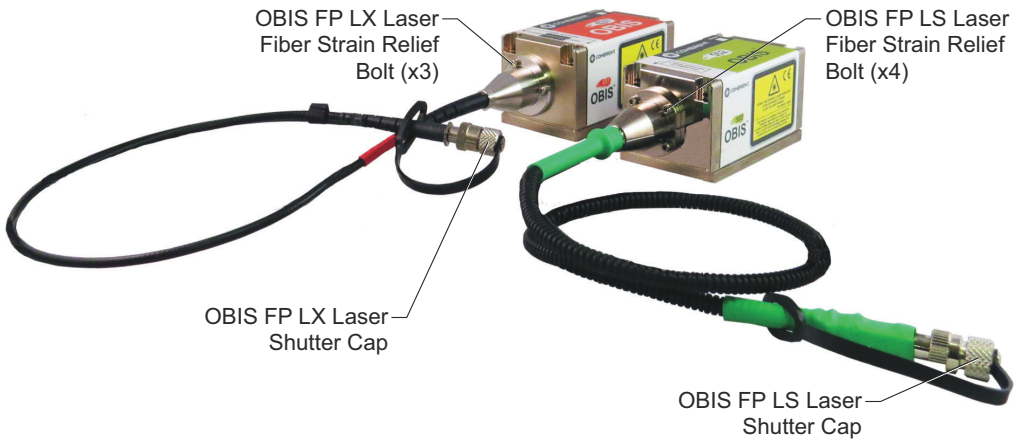


Figure 2-5. OBIS FP Laser

NOTICE
DO NOT adjust the fiber strain relief bolts—see Figure 2-5 for the location of the bolts. These bolts are for fiber cable strain relief, not to adjust the fiber.

The OBIS extended life fiber interface is not patch cord-compatible (except for the OBIS lasers at 633nm or higher wavelengths.).

Figure 2-6 shows the shutter cap of the OBIS fiber-pigtailed laser in the Open and Closed position.

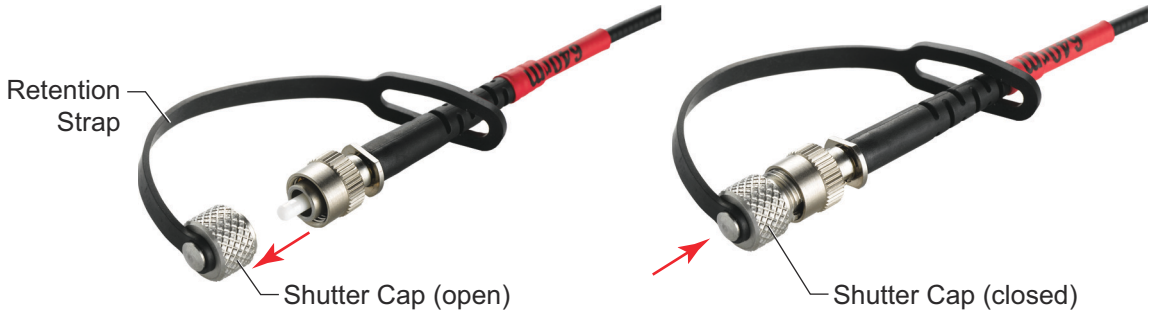


Figure 2-6. OBIS FP Shutter Cap in Open and Closed Position

2.2.3 Laser Back Panel Connections

Figure 2-7 shows the indicators and connectors on the laser back panel.

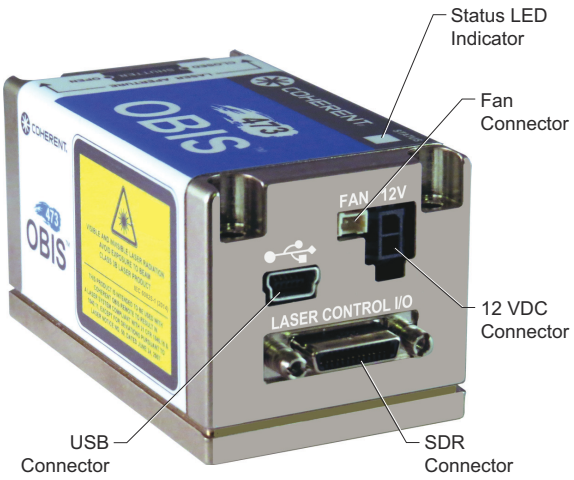


Figure 2-7. OBIS Laser Back Panel

2.2.3.1 12 VDC Connector

The 12 VDC connector, shown in Figure 2-8, brings 12 Volt DC power to the laser. This connector also connects the laser to the power supply if the DC power is not supplied through the SDR connector.

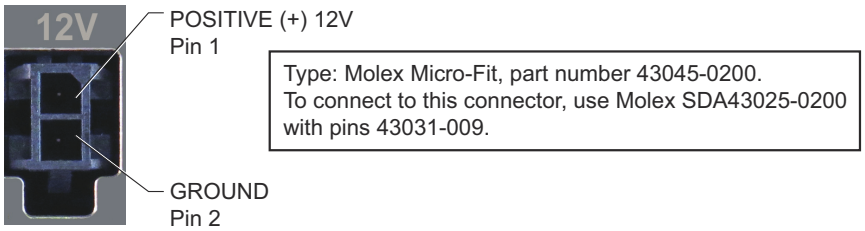


Figure 2-8. 12 VDC Supply Connector Pin Location

CAUTION!
Only connect 12 VDC power to the OBIS Remote or the laser. *DO NOT* connect power (12 VDC) to both the laser and the remote.

2.2.3.2 Fan Connector

The Fan connector, shown in Figure 2-9, provides a 12V outlet to supply a fan that cools the heatsink of the laser.

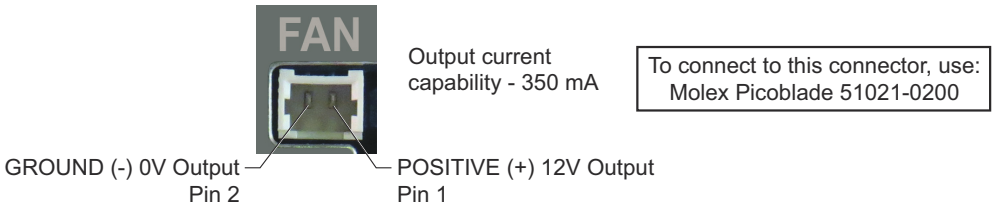


Figure 2-9. Fan Connector Pin Location

2.2.3.3 SDR Connector

Use the connector shown in Figure 2-10 to connect a SDR cable between the laser and the OBIS Remote. Type: 3M 12226-8250-00FR.Refer to Table 2-1, “OBIS Laser System Components and Accessories,” on page 6.

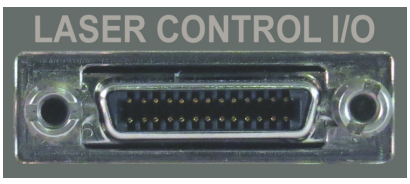


Figure 2-10. SDR Connector

2.2.3.4 USB Connector

The standard Mini-B connector shown in Figure 2-11 makes a connection to a PC for remote control of the laser.

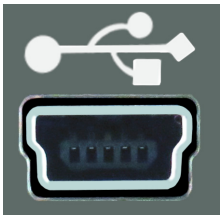


Figure 2-11. USB Connector

2.2.3.5 Status LED Indicator

The three-color LED located on the laser (shown in Figure 2-12) indicates the status of the laser. See Table I-3 (p. 135) for a description of the laser colors and display patterns.

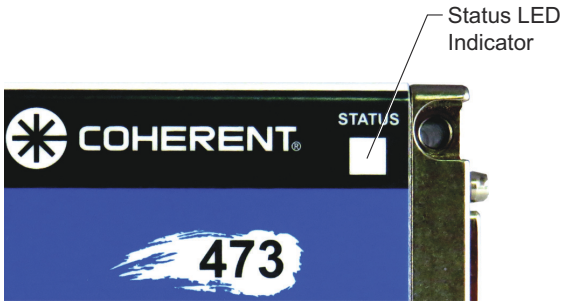


Figure 2-12. Status LED Indicator

2.2.4 Connection Configurations

This section describes the possible laser connection configurations.

Figure 2-13 shows the SDR connector. Use this to connect a compatible OBIS Remote.

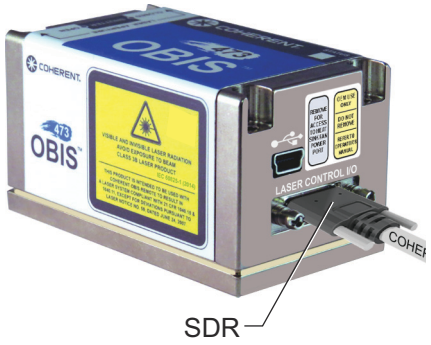


Figure 2-13. Laser System Connection using SDR Connector

Figure 2-14 shows the USB and Power connections typically used in an OEM configuration.

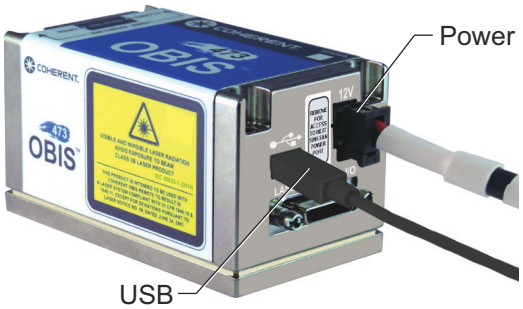


Figure 2-14. Laser System Connection in an OEM Configuration

WARNING!
Do NOT Use the Power Cable and the SDR cable at the same time!

The configuration shownwith both power and SDR cables together in Figure 2-15 is invalid.

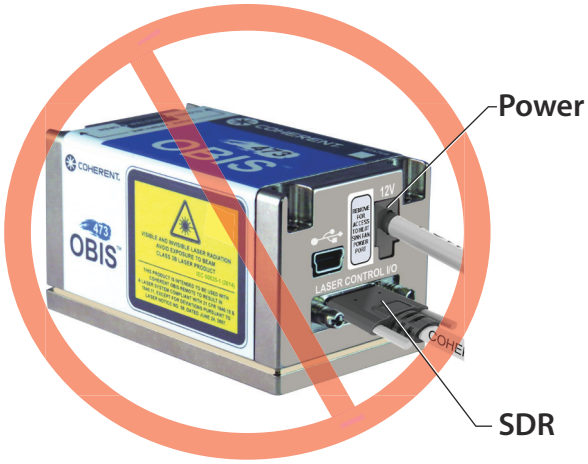


Figure 2-15. INVALID Laser System Configuration

Table 2-3 lists all possible laser connector configurations.

Table 2-3. Laser Connector Configurations

OBIS Laser Connections	Communication Priority	Operational Comments
SDR only	SDR	The SDR connector is used for power and all communications.
USB only	Not Applicable	The laser cannot function in this mode because no power is available.
Power only	Not Applicable	Initiates the Auto Start function. The laser starts automatically with laser emission. (Factory default is Auto Start enabled and CW operating mode.) **CAUTION! This configuration *DOES NOT* comply with CDRH laser safety features.** To DISABLE the Auto Start function, go to the Advanced tab of the Coherent Connection software program and deselect the check box for the **Laser Auto Start** box. To download Coherent Connection software, go to: https://www.coherent.com/resources
SDR and USB	SDR	The SDR connector supplies power and takes communication priority. For USB to have priority, refer to the information on pins 13 and 14 in Table 7-2 (p. 7-3) for enabling USB and not RS-485. ***NOTICE! If priority is given to USB (per pins 13 and 14 configuration) then the USB connection DOES function.***

Table 2-3. Laser Connector Configurations (Continued)

SDR and Power	SDR	The SDR connector supplies power and takes communication priority. ***NOTICE!*** **This is an invalid combination*!*** *NOT RECOMMENDED*
USB and Power	USB	The USB connector provides communication functions and Power provides power to the laser.

2.3 OBIS LX System Functional Block Diagram

The OBIS LX Direct-Diode-Laser (DDL) system uses an output beam sent from a semiconductor laser.

The output beam of the diode is first collimated by a high-aperture lens and then circularized to a round beam. A pickoff window sends a small amount of laser power to a photodiode. The photodiode signal is used for the feedback loop to stabilize the laser power.

A thermoelectric cooler (TEC) and temperature sensors are used to stabilize the temperature of the optical components and laser diode. Excess heat is dissipated through the base plate of the laser.

The laser is connected to the OBIS Remote by a SDR cable. The system is schematically shown by the block diagram in Figure 2-16.

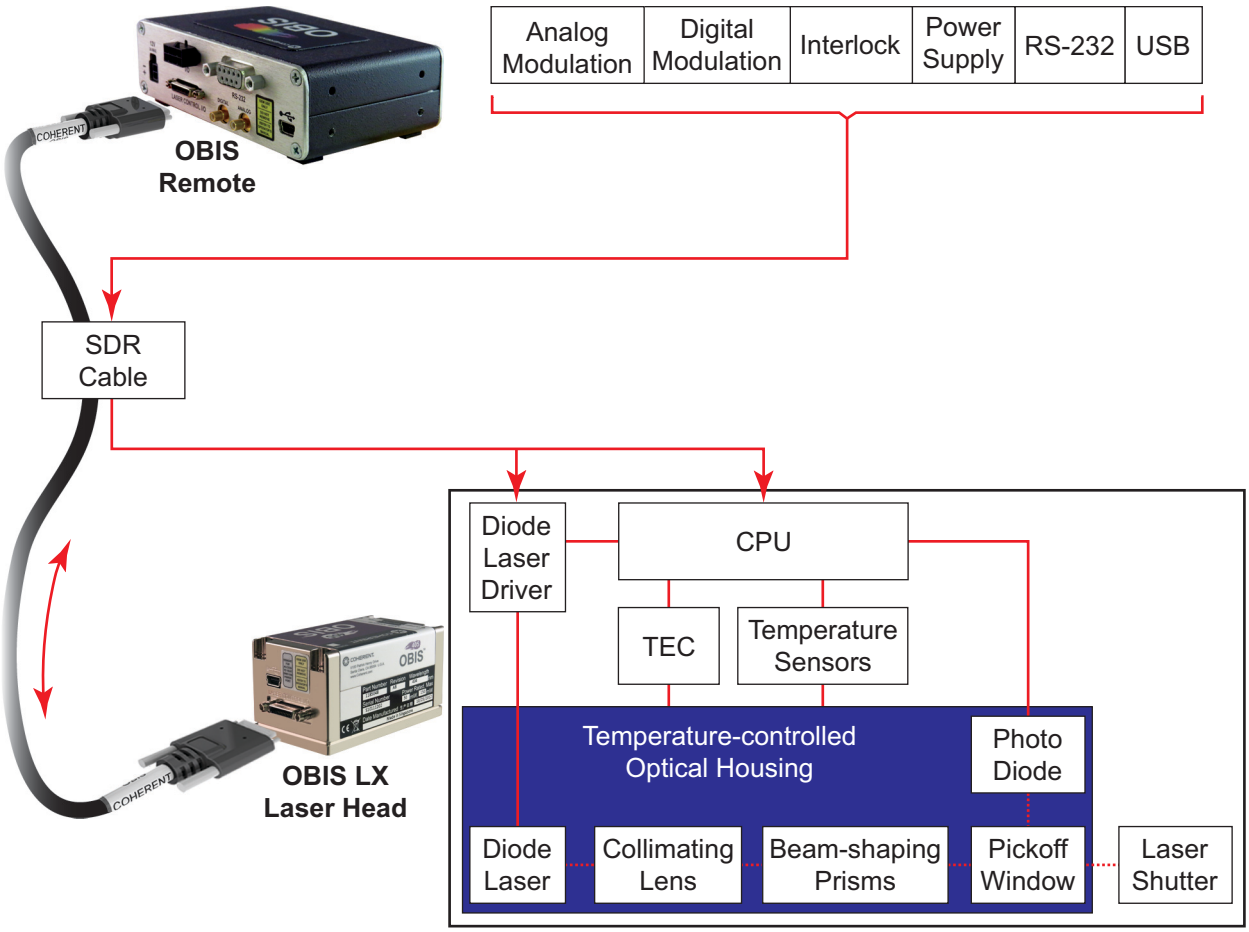


Figure 2-16. OBIS LX Functional Block Diagram

2.4 OBIS LS Laser Functional Block Diagram

The block diagram in Figure 2-17 shows the functional relationship of the components of the OBIS LS laser.

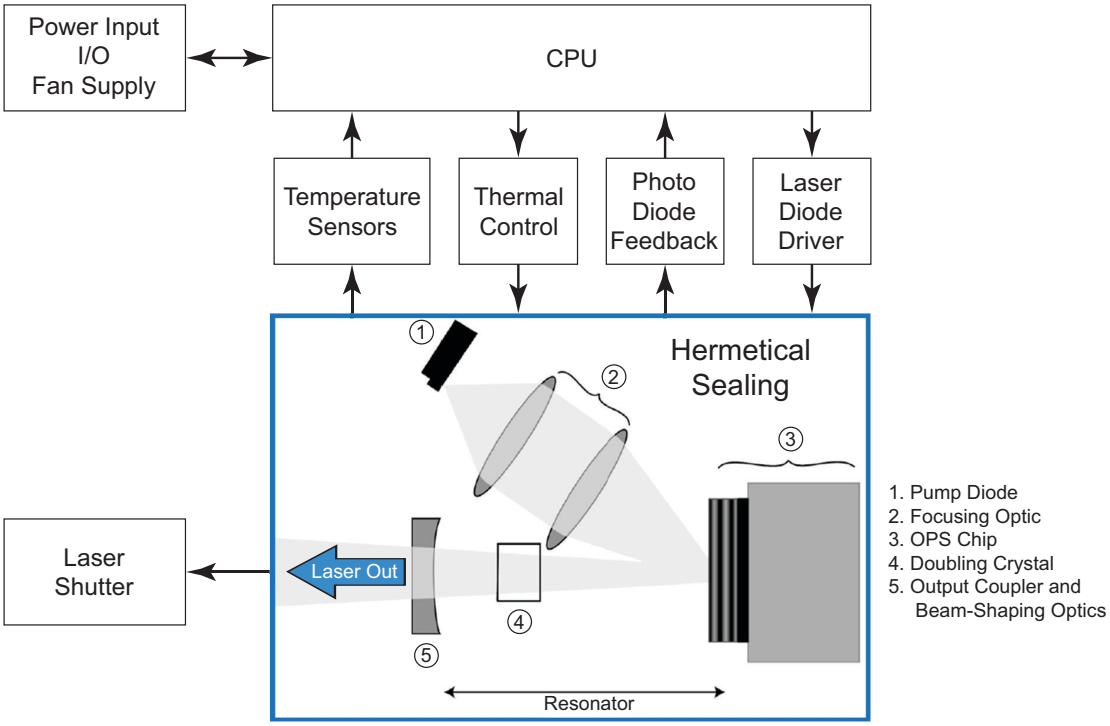


Figure 2-17. OBIS LS Functional Block Diagram

2.4.1 OBIS Laser and Remote Status Indicators

LED status indicators are provided on various components of the OBIS laser system and supporting products, including:

- OBIS Laser and OBIS Remote
- OBIS 6-Laser Remote
- OBIS Scientific Remote
- OBIS Laser Box

For more details about each of these remotes, see **Part 2** of the *OBIS LX/LS Operator's Manual*. Figure 2-18 shows the location of the LED status indicators on the OBIS Laser and the OBIS Remote:

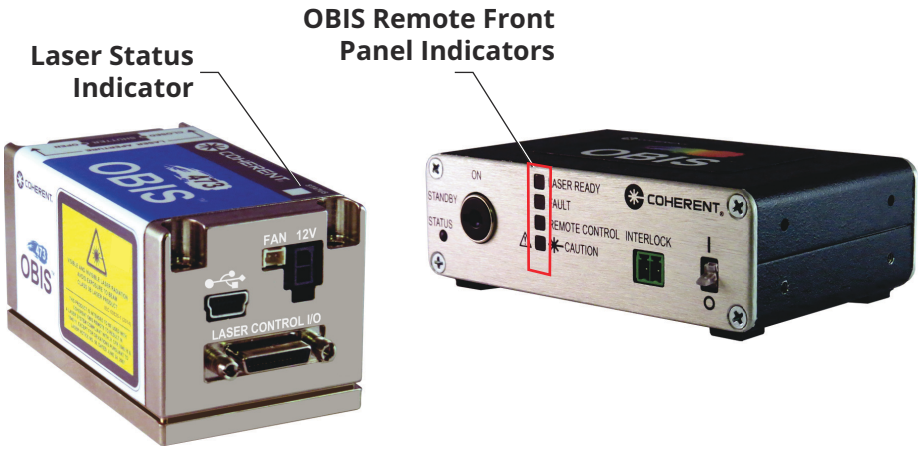


Figure 2-18. Remote Status Indicator Locations

Table 2-4 lists the possible states of the OBIS Laser and the OBIS Remote front panel indicators.

Table 2-4. OBIS Laser and OBIS Remote Indicators

Laser Status	Status Indicator on the Laser	OBIS Remote Front Panel Indicators				Interlock Laser Warning Light[a]
		Laser Ready	Fault	Remote Control	Caution	
Fault[b]	**Red**	**OFF**	**Red**	ON only when USB/ RS-232 connected; otherwise, OFF	**OFF**	**OFF**
Warm-up	**Flashing green**	**Flashing green**	**OFF**		**OFF**	**OFF**
STANDBY	**Blue**	**OFF**	**OFF**		**OFF**	**OFF**
CDRH 5-second Delay	White	**Flashing green**	**OFF**		ON	ON
Laser Emission but not at Set Power Level[c]	White	**Flashing green**	**OFF**		ON	ON
Laser Ready[d]	White	**ON**	**OFF**		ON	ON

a. The user has the option of connecting an external LED in series to the interlock (12V, 20 mA). This optional LED accessory is available from Coherent—refer to Table B-1 (p. B-1) for ordering information.
b. More data regarding laser faults is shown in Table C-6 (p. C-14).
c. Power has not reached the Set Power Level.

d. “Laser Ready” means the laser operates in constant-power mode and power has reached the Set Power Level.

The blue flashing LED is limited to the ‘Status’ LED by the Keyswitch. If there is a Keyswitch error, the LED flashes in blue. The Keyswitch error results from the power being applied to the laser with the Keyswitch ON.

For safety reasons, the Keyswitch cannot be turned ON during a power-on cycle. To clear the error, the user must turn the Keyswitch to ‘Standby’ and then back to the ON position.

2.4.2 Dimensions for the OBIS LX/LS Lasers

This section provides dimensions for the following lasers:

- OBIS LX/LS Laser
- OBIS LX Fiber-Pigtail (FP) Laser
- OBIS LS Fiber-Pigtail (FP) Laser

Coherent product information and related software is available in one easily accessible location on the Coherent website. Filter searches by product type, document category, or both. To download current drawing dimensions and product details, as well as manuals and software, go to:
https://www.coherent.com/resources

2.4.2.1 OBIS LX/LS Lasers

Figure 2-19 shows the dimensions for the OBIS LX/LS Lasers.

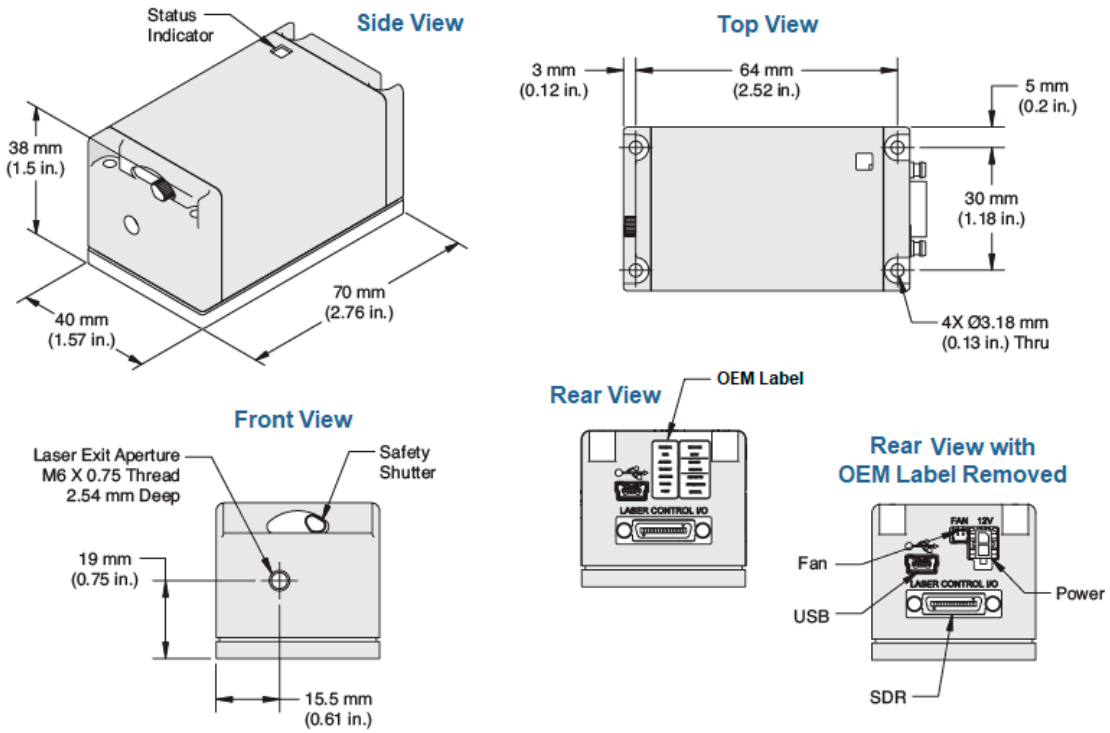


Figure 2-19. OBIS LX/LS Laser Dimensions

2.4.2.2 OBIS LX FP (Fiber-Pigtail) Laser

Figure 2-20 shows the dimensions for the OBIS LX FP (Fiber-Pigtailed) laser.

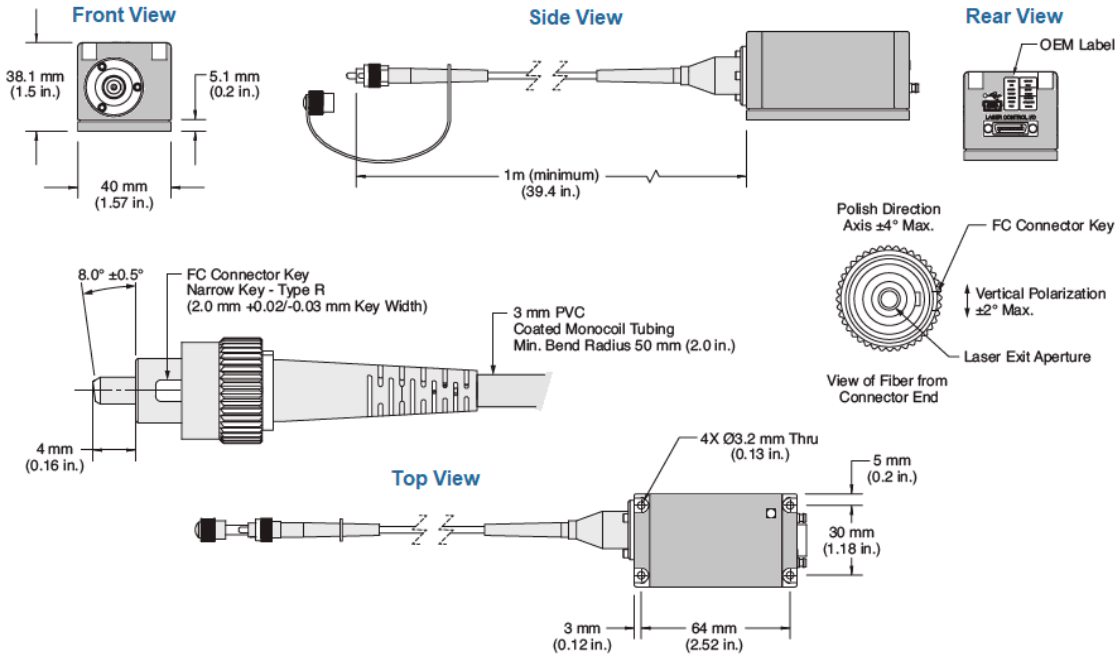


Figure 2-20. OBIS LX FP (Fiber Pigtail) Laser Dimensions

2.4.2.3 OBIS LS FP (Fiber-Pigtail) Laser

Figure 2-21 shows the dimensions for the OBIS LS FP (Fiber-Pigtail) laser.

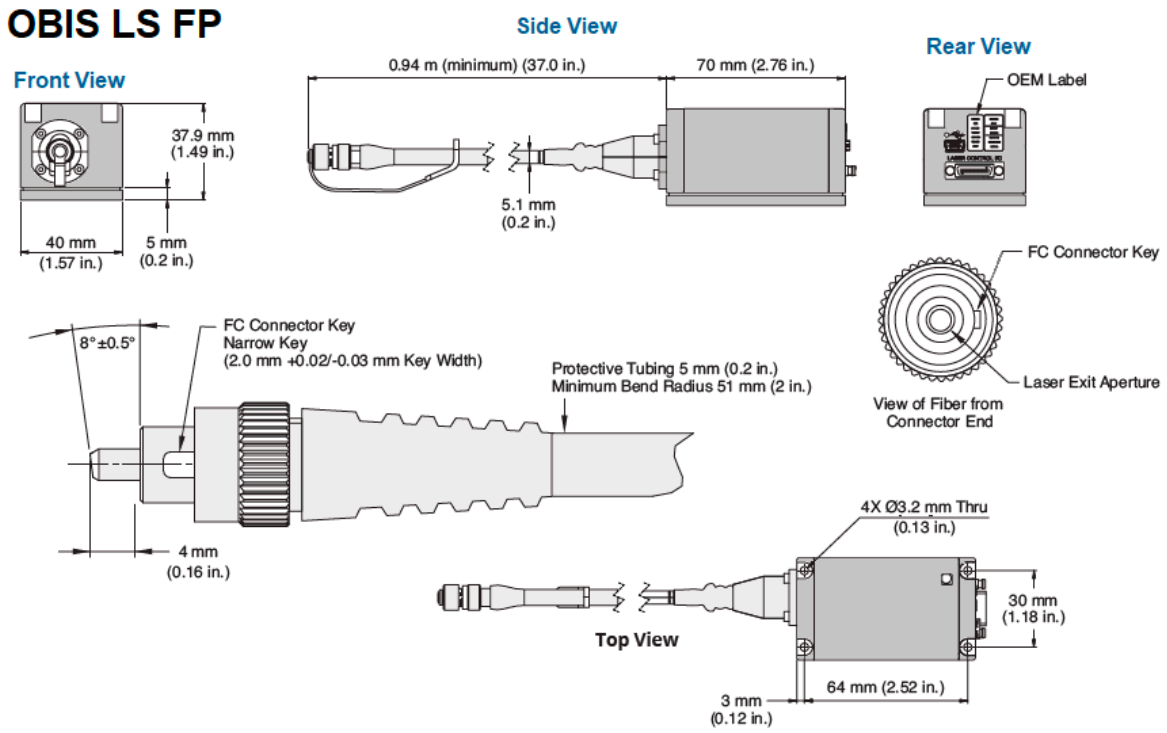


Figure 2-21. OBIS LS FP (Fiber Pigtail) Laser Dimensions

2.5 Heatsink

OBIS lasers require heatsinking because the base plate of the laser is cooled by conduction.While a heatsink is not supplied, and the purchase of a Coherent heatsink is optional. However, a Coherent heatsink or other heatsink is necessary for proper cooling and performance.

The optional OBIS heatsink accessory (P/N 1193289) shown in Figure 2-22 is sold separately—see "Appendix - Parts & Accessories" .

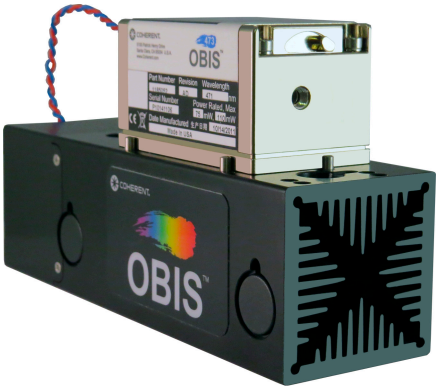


Figure 2-22. Heatsink (optional)

For OEM integration, refer to "Heatsink Requirement" (p. 103). That shows the heat dissipation of the OBIS Laser for given baseplate temperatures.

The dimensions of the optional OBIS Heatsink are shown in Figure 2-23.

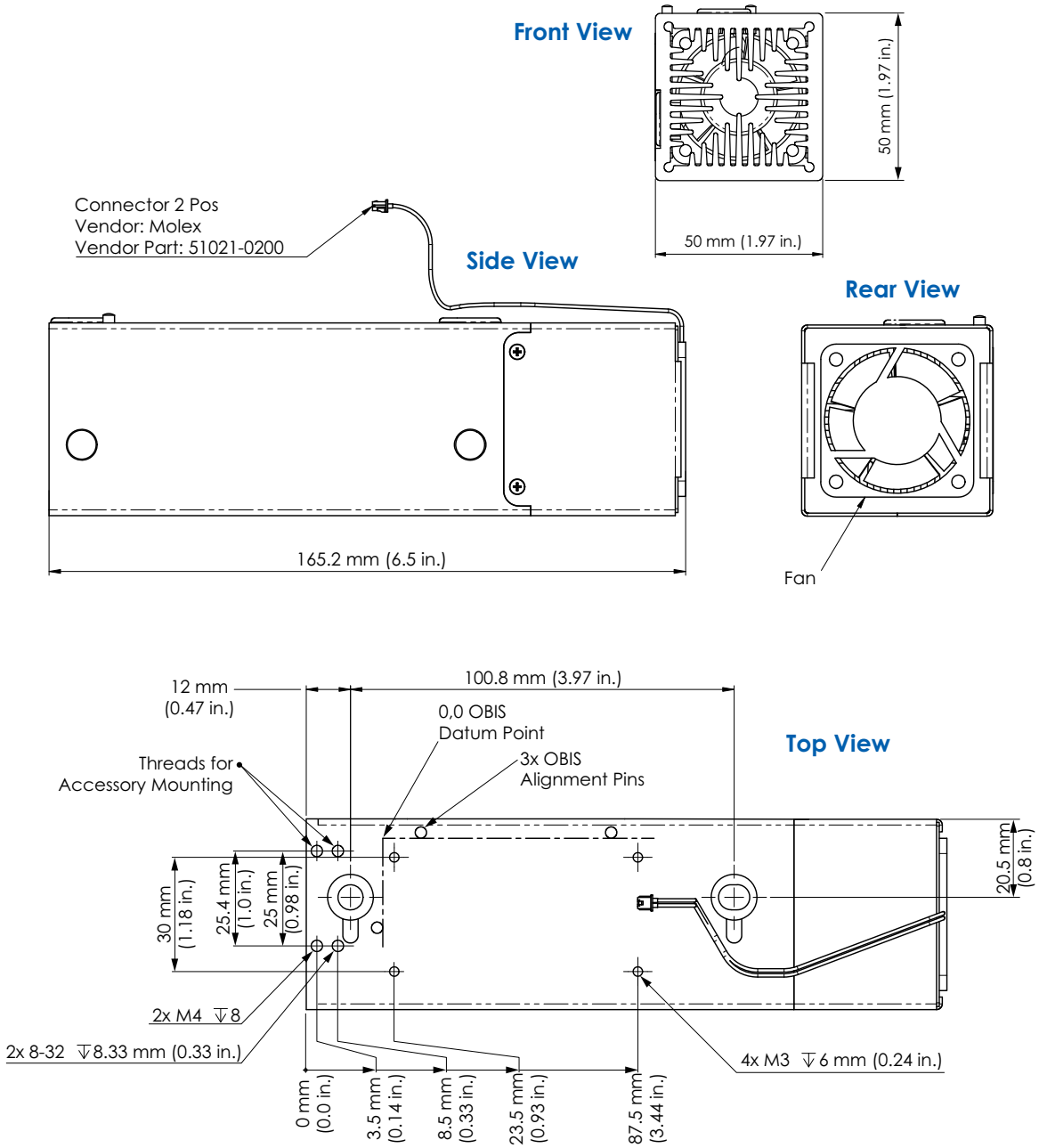


Figure 2-23. Heatsink Dimensions

2.5.1 Common Heatsink Features

The common features of the optional Heatsink OBIS LS/LX lasers include:

- Small footprint
- Rugged design
- Precision dowel pin laser positioning

- Convenient 69 mm (2.7 in.) beam height
- Integrated cooling fan with vibration isolation
- Output beam centered on standard table bolt pattern
- Universal mounting to imperial or metric bolt pattern
- Proven stable performance over time and temperature
- Fan power connector plugs directly to OBIS Laser
- Laser can be mounted on top or side for opposite polarization

2.6 Power Supply for OBIS Laser or OBIS Single-Laser Remote

The OBIS Laser System includes a power supply and cable, highlighted in Figure 2-24, that has a power ON indicator.

Figure 2-24. Power Supply for OBIS Laser System

The power supply is a universal AC input with a DC-regulated output. Use only the Coherent-approved power supply that comes standard with each system.

NOTICE

Be careful — power supplies may look almost the same but could have different output voltages that would damage the laser system.

Table 2-5 lists Power Supply specifications for the OBIS laser system.

Table 2-5. Power Supply Specifications

Description	Specification
Input voltage	100 to 240 VAC
Input current	0.55A
Input frequency	47 to 63 Hz.
Output voltage	12 VDC
Output current	2A
Rated output power	25W (maximum)
Output regulation	± 5%
Line voltage regulation	± 1% typical measured at full load

The dimensions for the OBIS Remote power supply are shown in Figure 2-25:

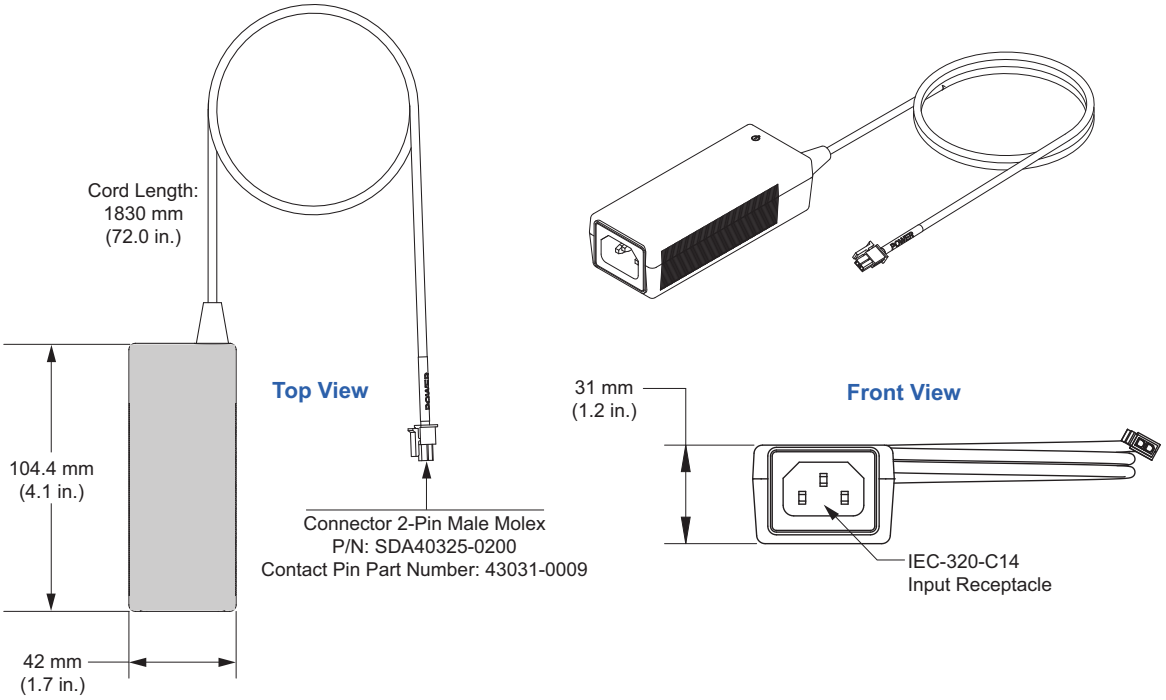


Figure 2-25. OBIS Remote Power Supply Dimensions

2.7 OBIS Single Laser Remote

The OBIS Single Laser Remote is a compact control box that allows connection to—and interface with—a single laser. OBIS Remotes are 'stackable', which allows installation of several Remotes in a single application.

CAUTION!
To be CDRH compliant, an OBIS Remote *must* be used with the laser—the laser alone is *NOT* CDRH compliant.

The OBIS Single Laser Remote has an ON/STANDBY keyswitch, a remote interlock and an emission indicator. With these safety features, the system is CDRH compliant. The modulation SMB connectors are for analog and/or digital modulation. Review Analog Modulation specifications for input requirements.

2.7.1 Front Panel Controls and Indicators

Indicators and connectors on the OBIS Remote front panel are shown in Figure 2-26.

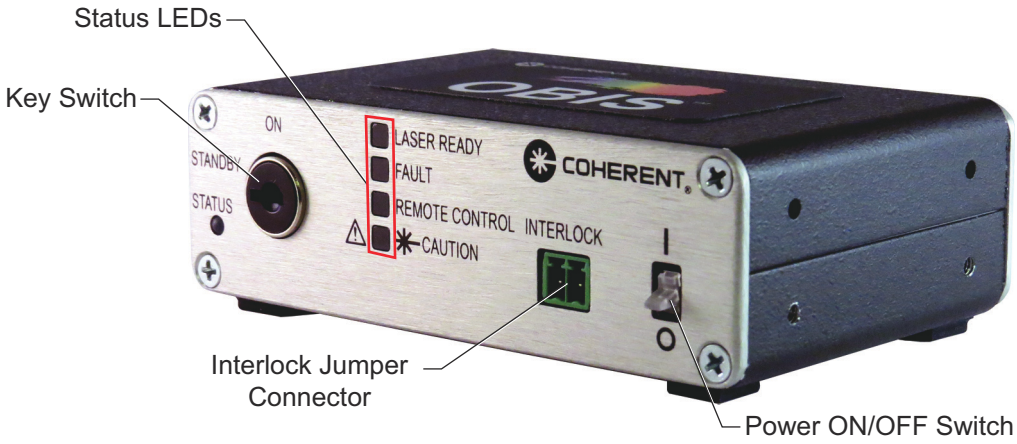


Figure 2-26. OBIS Remote Front Panel

2.7.1.1 Keyswitch

The Keyswitch is shown in Figure 2-27. Use this single keyswitch master power control for laser emission supply.

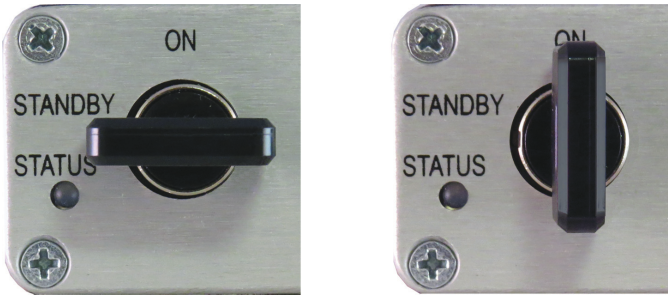


Figure 2-27. OBIS Remote Keyswitch

Figure 2-28 shows the keyswitch in the STANDBY and ON position.

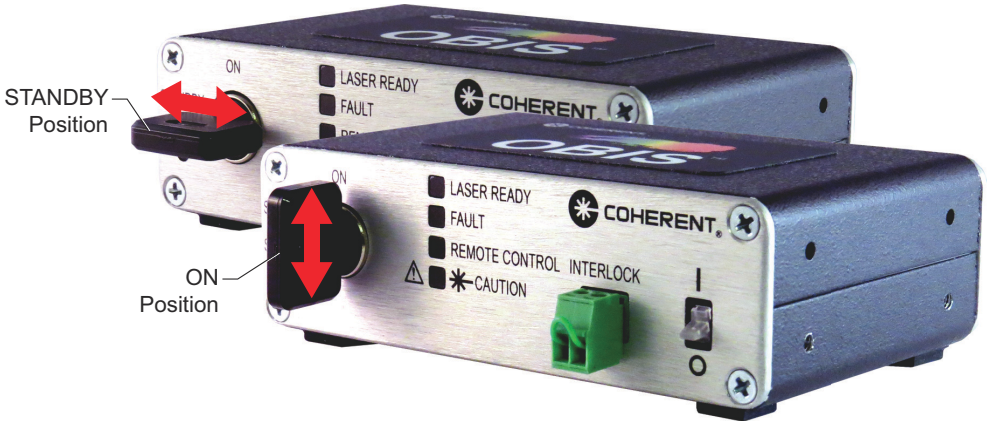


Figure 2-28. OBIS Remote Keyswitch STANDBY and ON Position

2.7.1.2 OBIS Remote Status Indicators

There are four status indicators on the front panel, as shown in Figure 2-29:

- Laser Ready
- Fault
- Remote Control
- Caution (laser emission) indicator

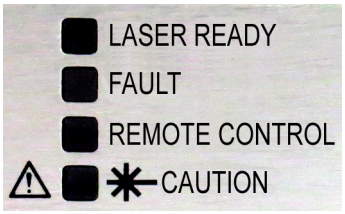


Figure 2-29. OBIS Remote Indicators

Refer to “OBIS Laser and Remote Status Indicators” (p. 19) for a list of Status states.

2.7.1.3 Interlock Jumper

Use the mechanical-style jumper shown in Figure 2-30 for interlock. The interlock has terminal style connections that allow connection to an external control device.

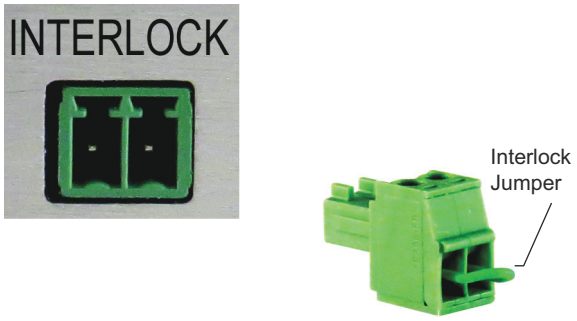


Figure 2-30. OBIS Remote Interlock Jumper

2.7.1.4 Power ON/OFF Switch

The Power ON/OFF switch, shown in Figure 2-31, applies power to the OBIS Remote. The switch illuminates green when power is applied.

Figure 2-31. OBIS Remote Power ON/OFF Switch

2.7.2 Back Panel Connections

The back panel of the OBIS Remote is shown in Figure 2-32).

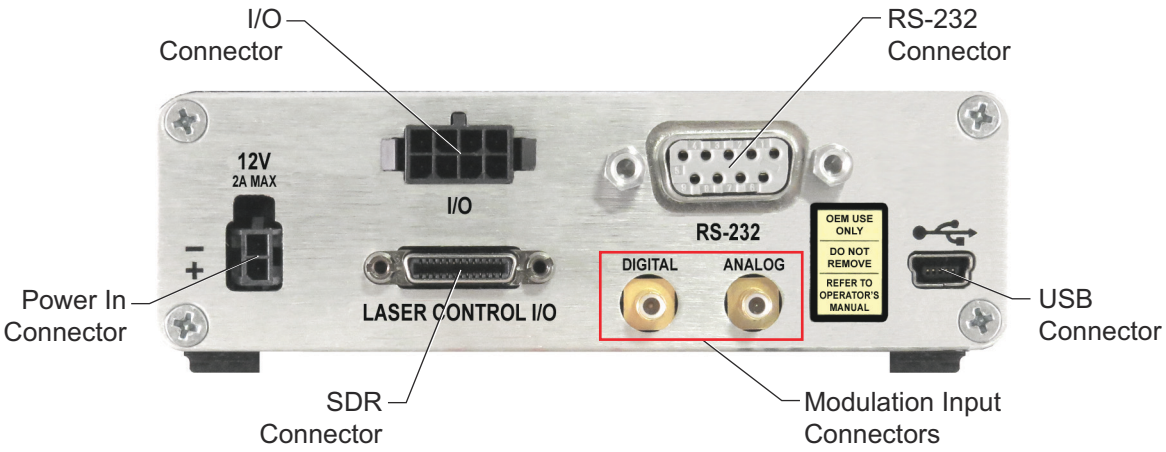


Figure 2-32. OBIS Remote Back Panel

The back panel includes the following connectors, described next:

- Power In
- I/O
- Laser Control (SDR)
- Modulation Input (SMB)
- RS-232
- USB (mini type-B)

The Auto Start switch is also found on the back panel.

2.7.2.1 Power-In Connector

Power is supplied to the OBIS Remote by a 5.5 mm, 2-pin, male, plug-and-socket connector (Part Number SDA40325-0200, contact pin 43031-0009), shown in Figure 2-33. The OBIS Remote supplies power to the laser through the SDR connector.

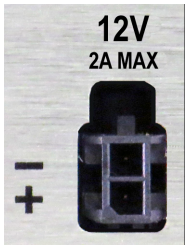


Figure 2-33. OBIS Remote Power In Connector

CAUTION!
On the OBIS Laser, *DO NOT connect the SDR connector and the Power-In connector at the same time*. **Instead, use the Power In connector on the OBIS Remote for the 12 VDC power input**.

All OBIS Remotes include the power supply (Scientific Remote power supply is internal). For more information about the power supply, refer to “Power Supply for OBIS Laser or OBIS Single-Laser Remote” (p. 26).

2.7.2.2 I/O Connector

The pin locations for the 8-pin header I/O connector are shown in Figure 2-34:

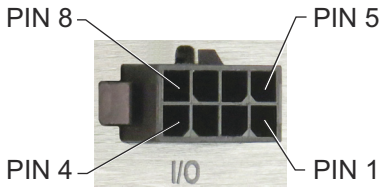


Figure 2-34. Pins on I/O Connector

Table 2-6 lists the specifications for the I/O Connector. Refer to Table 2-11 (p. 2-29) for additional signal information.

Table 2-6. I/O Connector Pin-Out Specifications

Signal Name	Pin Number	Direction
Laser Fault	1	Analog Out
Laser Ready	2	Analog Out
Base Plate Temperature	3	Analog Out
Power Monitor	4	Analog Out
Slow Digital Modulation	5	Digital In
Laser Diode Current	6	Analog Out
Ground Connection	7	GND
Ground Connection	8	GND

2.7.2.3 SDR Connector

Figure 2-35 shows the pin locations for the OBIS Remote SDR connector. Use the Coherent OBIS SDR cable to connect the OBIS Remote and the laser.

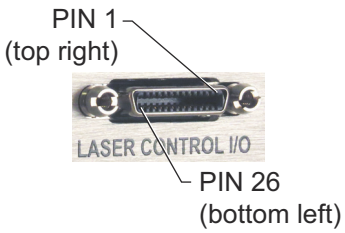


Figure 2-35. Pin Locations for the OBIS Remote SDR Connector

Table 2-7 lists the specifications for the OBIS Remote SDR connector.

Table 2-7. OBIS Remote SDR Connector Specifications

Description	Specification
Cable style[a]	26 conductor total 3 twisted shielded pair
Connectors	SDR both ends
Cable length	1 meter (standard) 3 meters (optional - maximum length) 0.3 meters (optional)

NOTICE

Use only a Coherent OBIS Laser-to-Remote SDR cable—DO NOT use a Camera Link cable. This can damage the system.

2.7.3 Modulation Input Connectors

The SMB connectors (one Digital, one Analog) are shown in Figure 2-36.

- The input impedance of the Digital input is 50 ohms.
- The input impedance of the Analog input is selectable to be either 50 ohms or 2K ohms.

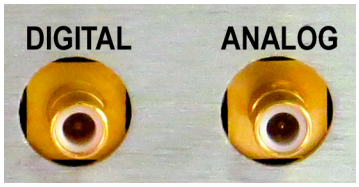


Figure 2-36. OBIS Remote Modulation Input Connectors

2.7.3.1 RS-232 Connector

Attach an RS-232 cable between the DB9F RS-232 connector (shown in Figure 2-37) and the RS-232 connector on a host computer. This connection allows commands to be sent to the OBIS Laser.

NOTE: Use a standard straight RS-232 cable. DO NOT use a Null Modem cable.

Figure 2-37. OBIS Remote RS-232 Connector

Table 2-8 lists settings for the OBIS Remote RS-232 connector.

Table 2-8. OBIS Remote RS-232 Communication Settings

Setting	Value
Baud	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Table 2-9 lists the Pin-Outs for the OBIS Remote RS-232 connector.

Table 2-9. OBIS Remote RS-232 Pin Connections

Pin	Signal	Pin	Signal
1	DCD (Data Carrier Detect)	6	DSR (Data Set Ready)
2	Rx (Receive)	7	RTS (Request to Send)
3	Tx (Transmit)	8	CTS (Clear to Send)
4	DTR (Data Terminal Ready)	9	Unused
5	GND (Ground)		

2.7.3.2 USB Connector

The USB Mini-B connector shown in Figure 2-38 allows connection to a host computer to the OBIS Remote and send commands
Recommendation: Use the USB connector at the OBIS Remote and not at the laser.

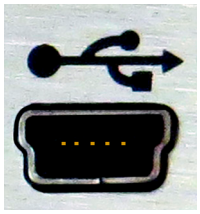


Figure 2-38. OBIS Remote USB Connector

2.7.4 Interlock Control

Connect the OBIS Remote to a remote switch to disable the system (if a door or panel is opened). The user has the option of connecting an external LED in series with the interlock circuit (which supplies a current source with 20 mA and up to 9V). Refer to “Appendix - Parts & Accessories” for a Coherent OBIS Remote Interlock Laser Warning Light assembly. Use this accessory to connect an external light to the interlock.

Table 2-10 lists laser behavior if the interlock circuit is opened during laser operation.

Table 2-10. OBIS Remote Interlock Behavior

Keyswitch	Interlock Circuit Opened	Interlock Circuit Opened and Closed Again
STANDBY	No fault displayed.	No fault displayed.
ON	Fault displayed.	Fault displayed. To clear the fault, return the keyswitch to STANDBY.

WARNING!
The interlock is a fused (12 VDC) line. DO NOT ground the interlock or apply any outside power to the circuit.

2.7.5 OBIS Laser-to-Remote (SDR) Cable

The OBIS Laser System includes a Coherent 1-meter SDR-style cable connection between the laser and the OBIS Remote.

NOTICE
Use only a Coherent OBIS Laser-to-Remote SDR cable—DO NOT use a Camera Link cable. This can damage the system.

2.7.6 Dimensions for the OBIS Remote

This section provides dimensions for the OBIS Remote, both with and without the mounting bracket. Figure 2-39 shows the dimensions for the standalone OBIS Remote.

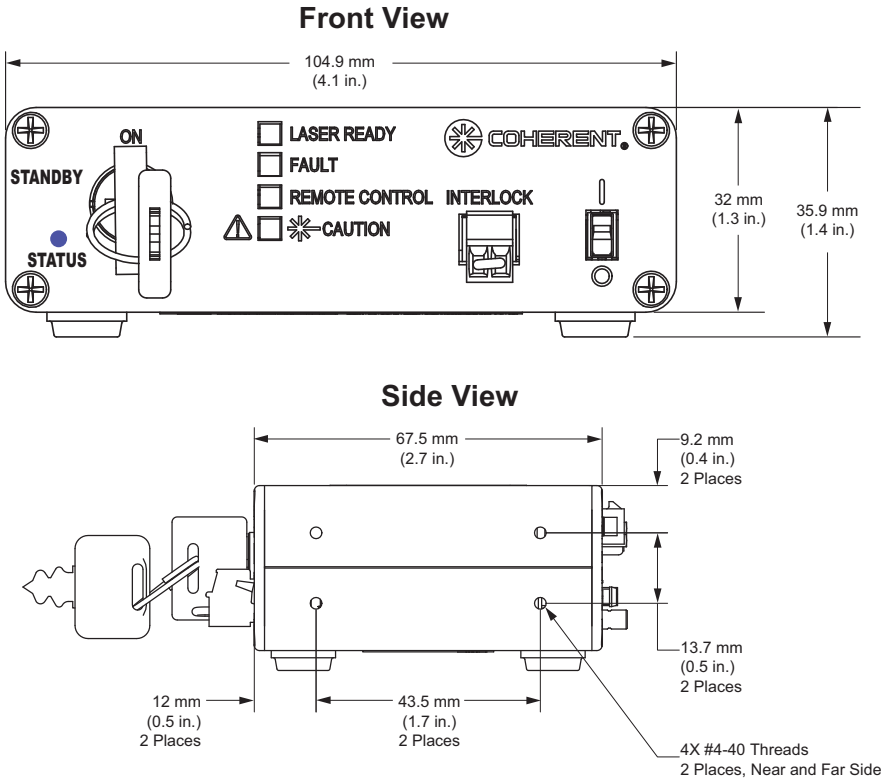


Figure 2-39. OBIS Remote Dimensions (Standalone)

Figure 2-40 shows the dimensions for the Top View of the OBIS Remote when using Mountain Brackets:

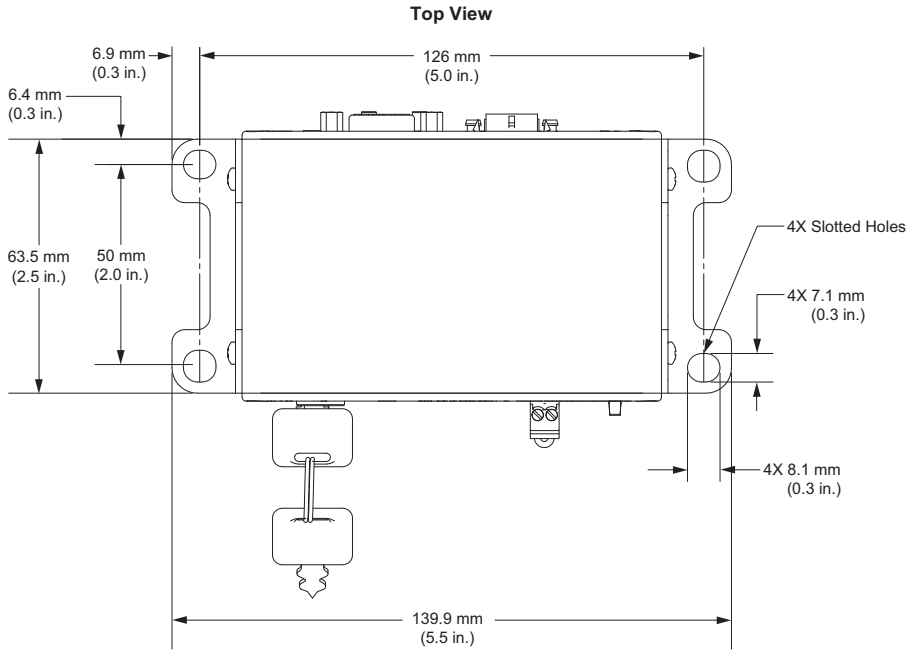


Figure 2-40. OBIS Remote (with Mounting Brackets) — TOP VIEW Dimensions

Figure 2-41 shows the dimensions for the Front View of the OBIS Remote when using Mountain Brackets:

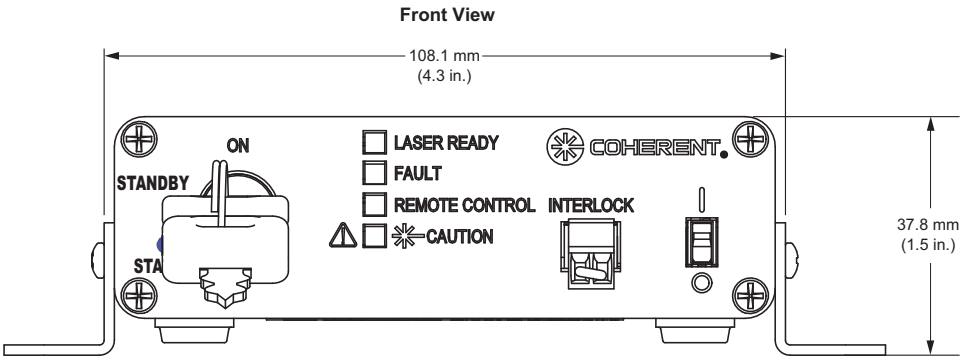


Figure 2-41. OBIS Remote (with Mounting Brackets) — FRONT VIEW Dimensions

Figure 2-42 shows the dimensions for the Side View of the OBIS Remote when using Mountain Brackets:

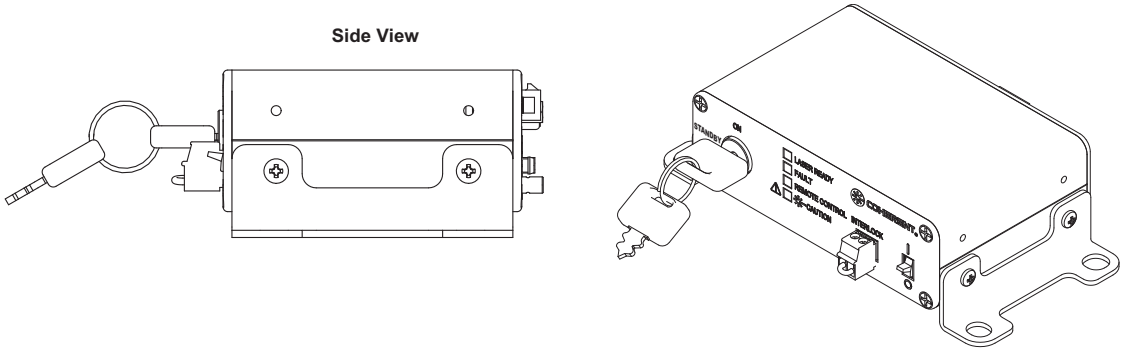


Figure 2-42. OBIS Remote (with Mounting Brackets) — SIDE VIEW Dimensions

2.7.7 Specifications

Table 2-11 lists the specifications for the OBIS Remote.

Table 2-11. OBIS Remote Specifications

Parameter	Specification
OBIS Remote Dimensions	68 x 105 x 33 mm
Operating Temperature Range	10 to 50°C
Storage Temperature Range	-20 to 70°C
Interlock(s)	One keyswitch One dual pin
Power Input	12V ± 2V DC
Modulation Connectors	One digital: 50 ohm input impedance, signal levels from 0 to 5V. One analog: Selectable input impedance of either 50 ohms or 2K ohms. Signal levels from 0 to 5V.
Modulation Connector Style	SMB
Indicators	
Caution (Emission)	Laser emission possible
Fault	Laser reports fault or OBIS Remote fault
Remote Control	1. Host USB enumerated 2. RS-232 connected

Table 2-11. OBIS Remote Specifications (Continued)

Parameter	Specification	
Laser Ready	Laser is running at set power ± 2%	
I/O Connector	This is an 8-pin header connector. Connector type at OBIS Remote: Molex Micro Fit 43020-0800. Mating connector: Molex Micro Fit 43025-0800 and either Molex Micro Fit Crimp Terminals 43030 or 46235.	
Connector Signals		
Laser Fault Output Signal	0V - no fault 3.3V - fault	< 0.5V: laser OK, > 2.5V: laser error Output impedance is < 200 Ohm
Laser Ready Output Signal	0V - otherwise, 3.3V - set power ± 2%	> 2.5V when laser output power is within ± 2% set power Output impedance < 200 Ohm
Baseplate Temperature Output Signal	0V - below (temperature upper limit - 10°C) 1.65V - between upper limit and (upper limit - 10°C) 3.3V - above upper limit	
Power Monitor Signal	0 to 2V represents 0 to 110% of the Laser Output power	
Slow Digital Modulation Input Signal	0 to 3.3V TTL logic level 5 kOhm input impedance 1 MHz maximum speed	
Diode Current Monitor Signal	0 to 2 volts represent 0 to100% of the maximal allowed current	
USB Connector	Mini-B Type	
Power In Connector	2-pin Molex	
RS-232 Connector	DB-9 standard female	

3 HARDWARE INSTALLATION

The procedure in this section describes how to connect the OBIS Laser and OBIS Remote.

For integration applications and information on how to install the individual laser *without* the OBIS Remote, refer to “Integration” (p. 113).

CAUTION!
Operating the laser without the OBIS Remote is NOT CDRH compliant. To be CDRH compliant, an OBIS Remote must be used with the laser.

The user takes all responsibility for safety and correct compliance to CDRH 21 CFR 1040 and IEC60825-1. For information, refer to “OBIS Communications via a Terminal Program” (p. 106).

The installation procedure includes the following steps:

- Step 1: Install the heatsink (optional) (p. 43)
- Step 2: Mount the laser (p. 46)
- Step 3: Add fan power (optional) (p. 48)
- Step 4: Connect the SDR cable (p. 49)
- Step 5: Connect power (p. 50)
- Step 6: Connect the interlock jumper (p. 50)
- Step 7: Connect USB/RS-232 (optional) (p. 51)
- Step 8: Clean the OBIS fiber tip (OBIS fiber-pigtailed lasers only) (p. 53)

3.1 Step 1: Install the Heatsink

The mounting of any laser is important to maintain beam stability over time and temperature. The Coherent OBIS heatsink is the result of important design research and testing, and provides correct thermal dissipation and mechanical positioning. While a heatsink is not supplied, and the purchase of a Coherent heatsink is optional, a Coherent or other heatsink is necessary.

1. Remove the two heatsink plugs to access the mounting holes, as shown in Figure 3-1. **The plate is not included**.

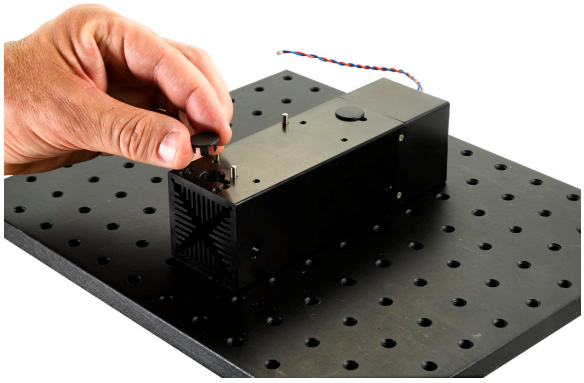


Figure 3-1. Remove the Heatsink Plugs

Figure 3-2 identifies the locations for the heatsink plugs.

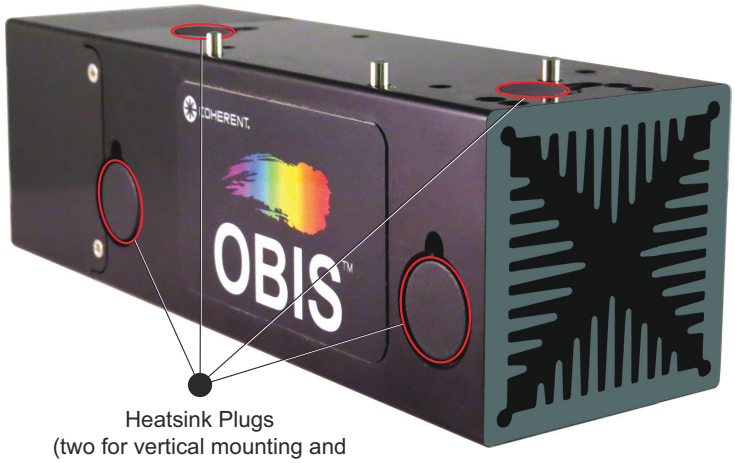


Figure 3-2. Heatsink Plug Locations

2. Fasten the heatsink to the desired location using 1/4-20 x 0.625" L or M6x16 mm mounting screws, as shown in Figure 3-3. Make sure the ends of the heatsink remain clear for correct air flow.
3. Torque the two mounting screws to 4.5 Nm (635 oz in), as shown in Figure 3-4.
4. Replace the heatsink plugs to the original position in the heatsink. *This step is mandatory to ensure efficient cooling*.

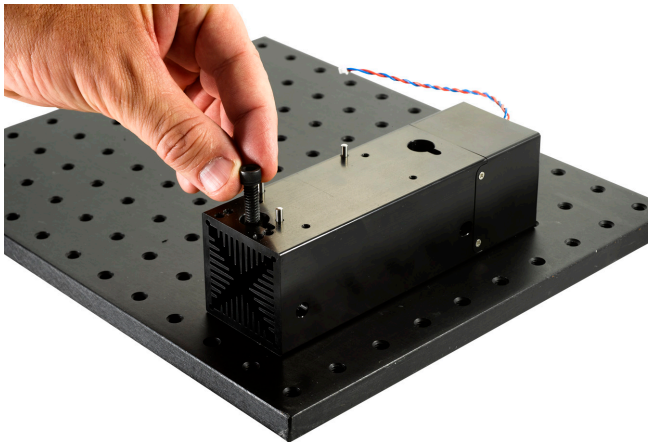


Figure 3-3. Bolt the Heatsink to the Desired Location

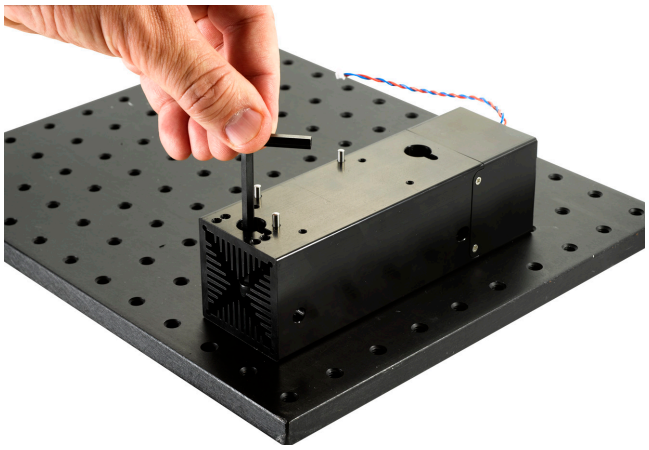


Figure 3-4. Torque the Mounting Screws

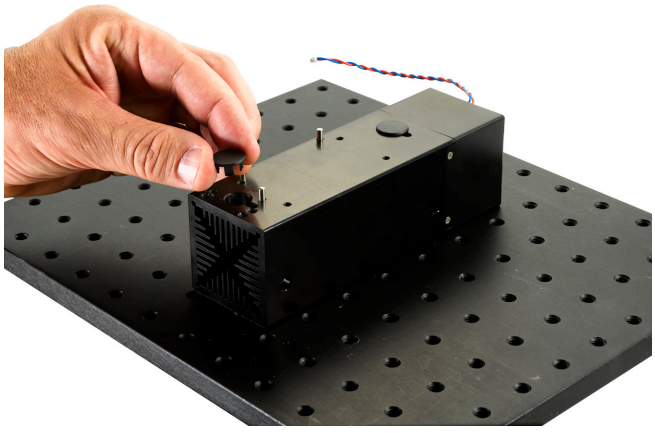


Figure 3-5. Replace the Heatsink Plugs

3.2 Step 2: Mount the Laser

NOTICE

An optical plate with mounting holes spaced ~1" apart is not a valid mounting surface without the use of an OBIS Heatsink.

1. Secure the Coherent heatsink or other heatsink to the desired location. Make sure that the ends of the heatsink remain clear for correct air flow.
2. Align the laser on the heatsink using the dowel pins to hold the laser in the correct location. Use the M3x35 mm screw kit (supplied) to secure the laser to the heatsink. Use the washers to spread the tightening force.

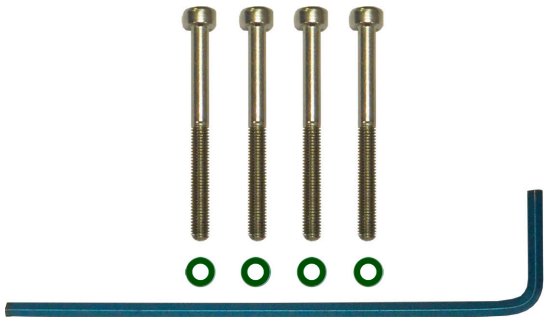


Figure 3-6. Provided Mounting Screw Kit for OBIS Laser

NOTICE

DO NOT use thermal grease or thermal compounds. The use of thermal grease or thermal compounds will void the warranty.

3. Align the Laser to the Heatsink, as shown in Figure 3-7.
4. Install the Mounting Screws and Washers, as shown in Figure 3-8.
5. Tighten the screws in a diagonal pattern for best pointing stability. Torque the mounting screws to 0.25 N·m (35.4 oz·in.) in the following sequence: 1-2-3-4. Use the same diagonal pattern for the last torque setting of 1 N·m (141.6 oz·in.), as shown in Figure 3-9.
6. Tighten the Mounting Screws, as shown in Figure 3-10.

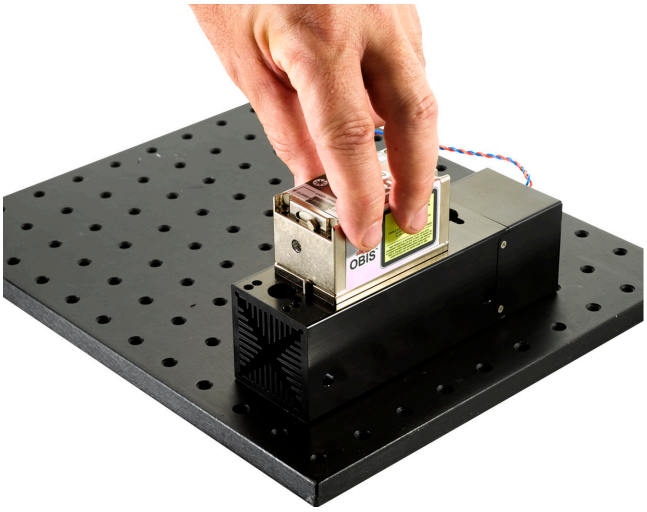


Figure 3-7. Align the Laser to the Heatsink

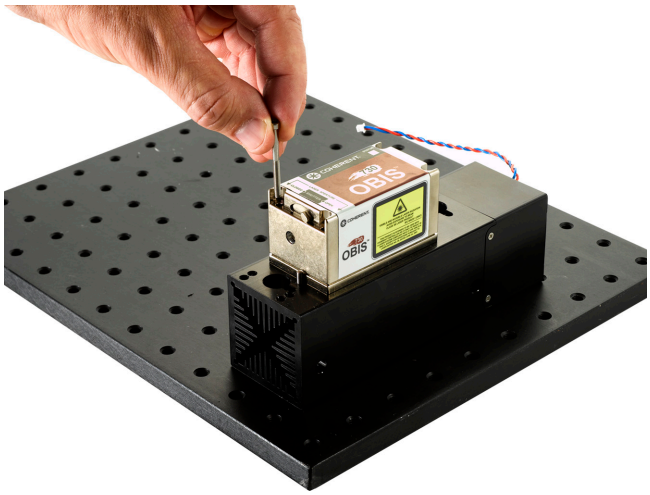


Figure 3-8. Install the Mounting Screws and Washers

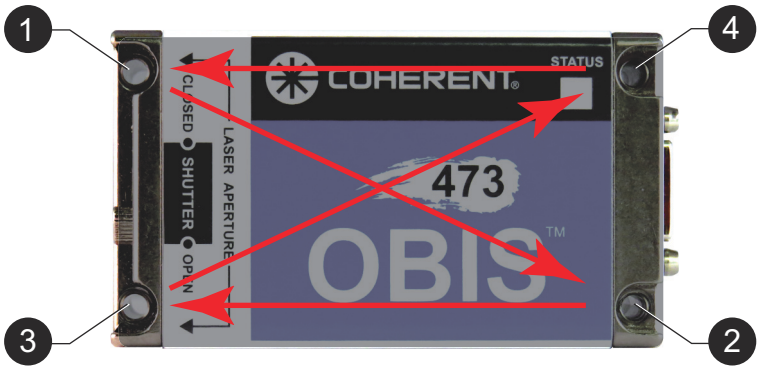


Figure 3-9. Tightening Pattern to Mount the OBIS Laser

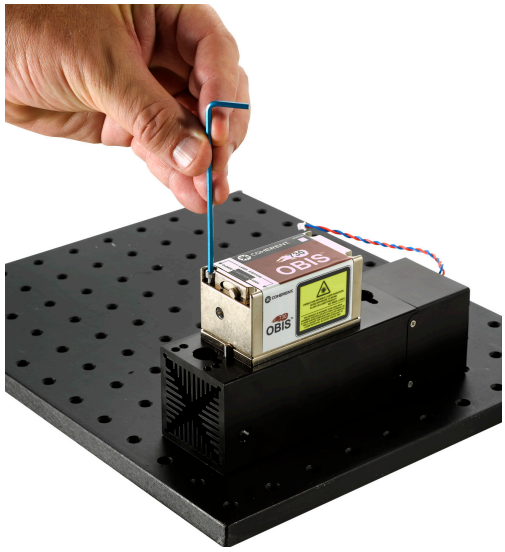


Figure 3-10. Tighten the Mounting Screws

3.3 Step 3:Add Fan Power (optional)

If fan operation is required, follow these steps:

1. Remove the gray label that covers the OBIS Fan connector.

NOTICE
DO NOT remove the yellow label next to the gray label.

Figure 3-11. Remove the Gray Label from the OBIS Fan Connector

2. Connect the heatsink fan cable to the Fan connector on the OBIS, as shown in Figure 3-12. The fan cable supplies power to the heatsink fan.

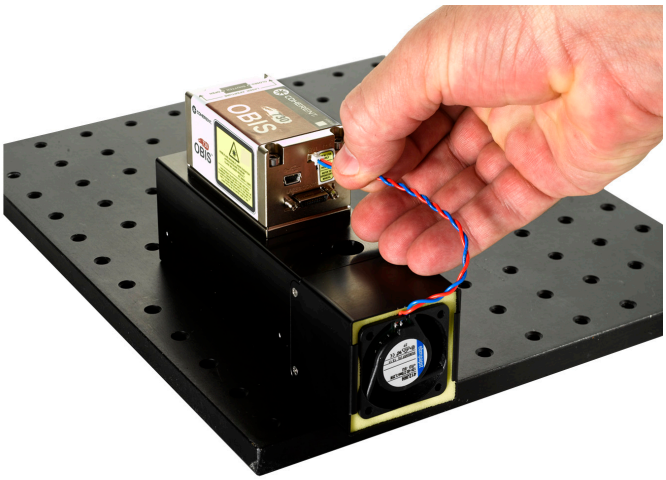


Figure 3-12. Connect the Fan Cable to the OBIS Fan Connector

3.4 Step 4: Connect the SDR Cable

Attach the SDR connector to the OBIS laser, as shown in Figure 3-13.

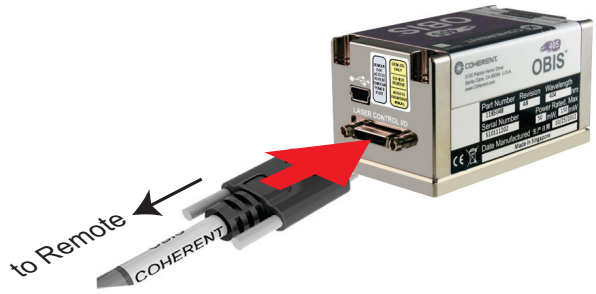


Figure 3-13. Connect the SDR Cable to the Laser

Attach the other end of the SDR connector to the OBIS Remote, as shown in Figure 3-14.

Tighten the thumbscrews on the connector at both ends to hand-tight.

Figure 3-14. Connect the SDR Cable to the Remote

3.5 Step 5: Connect Power

Connect the 12 VDC power to the OBIS Remote, as shown in Figure 3-15.

Figure 3-15. Connect Power

The Coherent OBIS Laser System includes a power supply (that has a power ON indicator). For more information and specifications about the power supply, refer to "Power Supply for OBIS Laser or OBIS Single-Laser Remote" (p. 24).

3.6 Step 6: Connect the Interlock Jumper

Connect the interlock jumper as shown in Figure 3-16. For interlock details and specifications, refer to "Interlock Control" (p. 33).

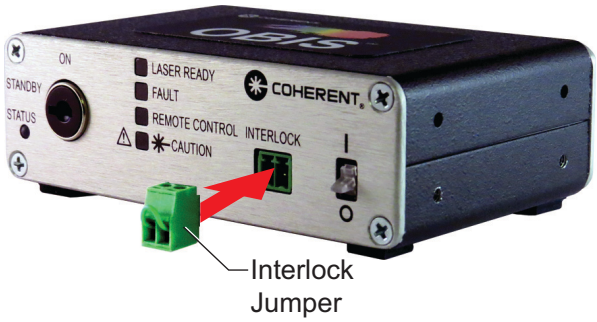


Figure 3-16. Connect the Interlock Jumper

3.7 Step 7: Connect USB/RS-232 (optional)

It is possible to control laser power or other parameters remotely through a USB or RS-232 connection (see notes, below)

3.7.1 Connect OBIS Remote (optional)

Connectors for a USB or RS-232 cable are located on the back panel of an OBIS Remote, as shown in Figure 3-17.

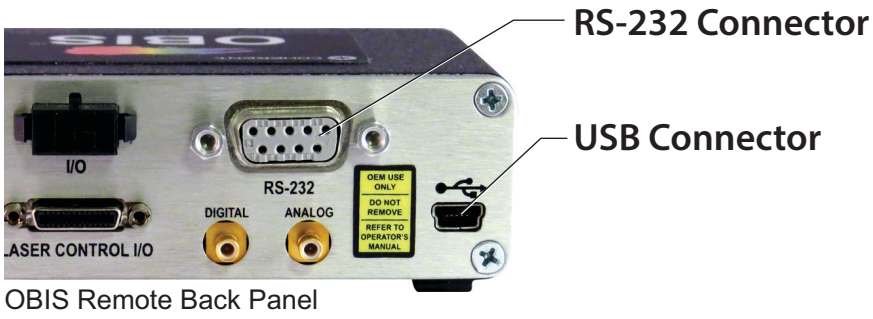


Figure 3-17. Connectors for a USB or RS-232 Cable

Connect a standard serial cable from the back of the OBIS Remote to the host workstation (PC or laptop).

NOTES:

- The OBIS Laser supports USB directly.
- The OBIS Single-Laser Remote supports RS-232 and USB.
- The OBIS 6-Laser Remote does not offer RS-232 or USB.

- The OBIS Scientific Remote supports RS-232, USB, and Ethernet.

This completes the OBIS Laser installation with the OBIS Remote.

3.7.2 Connect OBIS Laser Directly via USB

Figure 3-18 shows the USB connector on the back panel of the OBIS laser. This is a standard Mini-B USB connector that supports USB 2.0 communications.

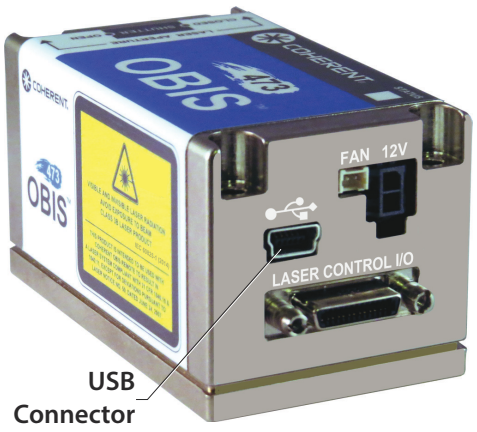


Figure 3-18. USB Connection at the Laser

Connect the OBIS LX/LS laser from the back panel of the laser to a USB port on the host computer.

NOTICE
The laser is shipped on a plastic plate. This is only a shipping plate and must be removed. It is NOT intended for sue as a heatsink mount.

NOTICE
For OBIS fiber pigtail lasers for Galaxy, the output connector is a FC/UFC where the tip is an Ultra Flat Polish (UFC) that is unique to the lasers for the Galaxy Beam Combiner.

NOTICE
DO NOT make a connection to the USB connector on the back panel of a OBIS Remote. Instead, the connection must be made to the USB connector on the OBIS *Laser*.

NOTICE
For OBIS fiber pigtail lasers for Galaxy, the output connector is a FC/UFC where the tip is an Ultra Flat Polish (UFC) that is unique to the lasers for the Galaxy Beam Combiner.

3.8 Step 8: Clean the OBIS Fiber Tip

NOTE: This section applies only to OBIS fiber-pigtailed lasers.

If using an OBIS **fiber-pigtailed laser**, read the following instructions for additional installation steps.

3.8.1 About OBIS Fiber Pigtailed (OBIS FP) Lasers

The fiber pigtail termination is complete with a FC/APC connector, as shown in Figure 3-19.

Figure 3-19. OBIS FP Laser

3.8.2 Clean and Inspect the Fiber Tip

The Fiber connector is cleaned to prevent optical degradation and optical or mechanical damage. Also, the connector must be installed in a dust-free and contamination-free environment when operating the laser in the application. This section describes how to inspect and clean fiber connectors before mating.

CAUTION!
Laser safety eyewear can be a hazard and a benefit. While eyewear protects the eye from possible exposure damage, it also blocks light at the laser wavelengths and prevents the operator from seeing the beam. Use extreme caution, even when using safety eyewear.

3.8.2.1 Importance of Inspection and Cleaning

A clean fiber tip is required for quality connections between fiber optic equipment. A basic and important maintenance procedure of a fiber optic system is to clean the equipment.

Any contamination in the fiber connection can cause failure of the component or the whole system. Even microscopic dust particles can cause a variety of problems for optical connections.

A particle that partially or completely blocks the core can create strong back reflections. These reflections can cause instability in the laser system. Other types of contamination must be removed from the fiber tip. Examples include:

- Oils (for example, from hands)
- Film residues (condensed from vapors in the air)
- Powdery coatings (left after water or other solvents evaporate)

These contaminants can be more difficult to remove than dust particles and, if not removed, can damage the equipment.

The output intensity at the fiber exit of OBIS lasers is so extreme that any contaminant can be burned into the fiber tip if it blocks the core while the laser is turned On, as shown in Figure 3-20. This burn can damage the optical surface so that it cannot be cleaned.

When fiber components are cleaned, always complete the steps carefully. The goal is to remove all dust or contamination and provide a clean environment for the fiber optic connection.

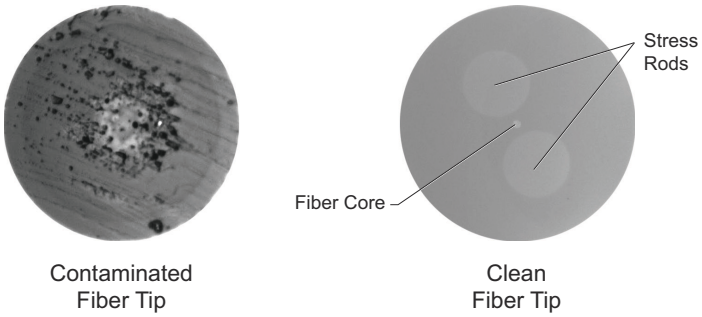


Figure 3-20. Example of Contaminated and Clean SM Fiber Tips

Remember that inspection, cleaning, and re-inspection are very important steps which must be done before any fiber connections are made.

3.8.2.2 General Inspection and Cleaning Process

CAUTION!
Do the following when cleaning:
—Always inspect and clean the connectors before making a connection.
—Never touch the tip of the fiber connectors.
—Never use alcohol or wet cleaning without ensuring a way that does not leave residue on the fiber tip.

1. Inspect the fiber tip with a fiberscope or microscope. Refer to Table 3.8.2.3, “Fiber Tip Inspection,” on page 56.The inspection of the fiber tip is done with either a desktop video fiberscope or a hand-held fiberscope. Both tools are customized microscopes used to inspect optical fibers. The scope should provide at least 200x total magnification. Table 3-1 shows examples of these tools.
2. If the tip is dirty, use the dry cleaning technique (p. 57) to clean it.
3. Re-inspect the fiber tip. If the connector is still dirty, repeat the dry cleaning technique (“Dry Cleaning Technique” (p. 57)) a second time.
4. Inspect the fiber tip. If the connector is still contaminated, clean it with the wet cleaning technique (“Wet Cleaning Technique” (p. 60)).
5. Inspect the fiber tip again. If the contaminate is still present, repeat the wet cleaning process until the fiber tip is clean.
6. If the fiber tip is still contaminated after several cleaning attempts with the wet cleaning technique, contact Coherent Technical Support:
   - By email: customer.support@coherent.com

Table 3-1. Fiber Optic Inspection Tools

P/N	Tool	Image
FS200	Fiber Optic Scope	
F1VM400USB	Desktop Video Fiber Inspection Microscope	
F1VSAPC25	FIS Fiber Optic Microscope Adapters	
A specific adapter is needed for the FC/APC (Fiber Connector/Angled Physical Contact) to properly inspect the fiber tip.		

3.8.2.3 Fiber Tip Inspection

To inspect the connector:

1. Make sure that the laser is turned off before starting the inspection.

WARNING!
Never look into a fiber while the laser is ON.
Never connect a fiber to a fiberscope while the laser is ON.
Always set the laser to Off before the fiber tip is inspected.

2. Put the applicable inspection adapter or probe on the fiberscope or microscope.

3. Unscrew and remove the fiber shutter cap from the fiber connector, as shown in Figure 3-21.

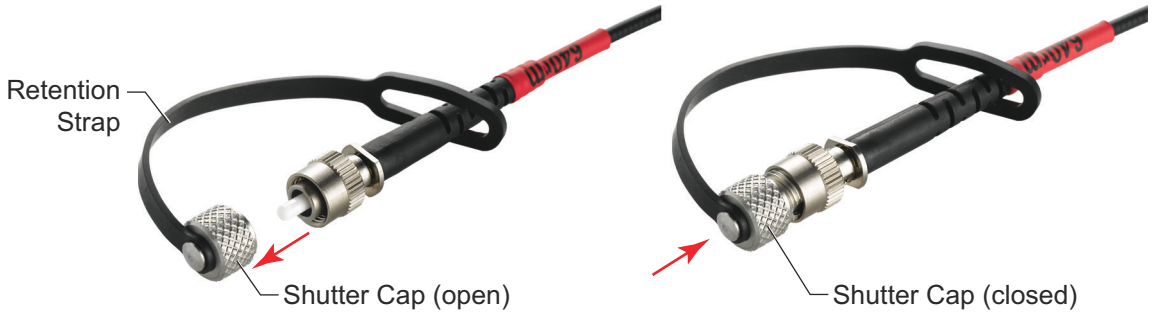


Figure 3-21. OBIS FP Shutter Cap in Open and Closed Position

4. Insert the fiber connector into the inspection adapter and adjust the focus ring so that a clear fiber tip image can be seen.
5. Clean the fiber tip and re-inspect, as necessary. Refer to the “General Inspection and Cleaning Process” (p. 55) for an overview on fiber tip cleaning.
6. Immediately plug the clean connector into the mating clean connector to decrease the risk of re-contamination.

3.8.2.4 Fiber Tip Cleaning Techniques

There are different cleaning methods:

- “Dry Cleaning Technique” (p. 57)
- “Wet Cleaning Technique” (p. 60)

NOTICE

No known cleaning method is 100% effective. It is imperative that inspection is included as part of the cleaning process. Incorrect cleaning can damage the equipment.

3.8.2.5 Dry Cleaning Technique

This section describes a dry cleaning technique that uses a cartridge cleaner. The recommended cartridge cleaning tools and examples (with source websites) are listed in Table 3-2:

To use the dry cleaning technique:

Table 3-2. Recommended Cartridge Cleaning Tools

Tool	Image	Source
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

WARNING!
Always set laser to off before the fiber tip is cleaned.

1. Make sure that the laser is set to Off before the inspection is started.
2. Unscrew and remove the fiber shutter cap.
3. Inspect the connector with a fiberscope. Refer to the "Fiber Tip Inspection" (p. 56).
4. If the connector is dirty, clean with a cartridge cleaner.
5. Press down and hold the thumb lever—the shutter slides back and exposes a new cleaning area, as shown in Figure 3-22:

Figure 3-22. Cleaning Slot 1

6. Hold the fiber tip lightly against the cleaning area (slot 1).
7. Pull the fiber tip lightly down the exposed cleaning area in the direction of the arrow or from top to bottom. At the same time, rotate the fiber 90 to 180 degrees.

Do not scrub the fiber against the fabric or use the same surface of the fabric more than once. Contamination or damage to the connector can happen.

8. Repeat steps 6 and 7 (above), using slot 2 instead of slot 1, as shown in Figure 3-23.

Figure 3-23. Cleaning Slot 2

9. Release the thumb lever to close the cleaning window.
10. Inspect the connector with the fiberscope. Refer to “Fiber Tip Inspection” (p. 56).
11. Repeat the inspection and cleaning processes, as necessary. If the contamination cannot be removed with the Dry Cleaning Technique, use the “Wet Cleaning Technique” (p. 60).

3.8.2.6 Wet Cleaning Technique

CAUTION!
Follow all safety instructions when using isopropyl/methanol alcohol (used for wet cleaning of the fiber tip). If a copy of the safety instructions for using alcohol isn't available, contact your vendor before following the cleaning instructions described in this section.

If it was not possible to completely remove the contamination by using the Dry Cleaning Technique, follow these steps for the Wet Cleaning Technique:

1. Press down and hold the thumb lever of the cartridge cleaning tool. The shutter slides back to expose a new cleaning area.
2. ***Carefully*** add 1 to 2 drops of isopropyl/methanol on both slots (1 and 2).
3. Hold the fiber tip lightly against the cleaning area (slot 1).
4. Pull the fiber tip lightly down the exposed cleaning area in the direction of the arrow or from top to bottom. At the same time, rotate the fiber 90 to 180 degrees.

CAUTION!
Do not scrub the fiber against the fabric or use the same surface of the fabric more than once. Contamination or damage to the connector can happen.

5. Release the thumb lever and press it down again to get an unexposed cleaning section.
6. Continue with Step 8 of the "Dry Cleaning Technique" (p. 57).
7. If the fiber tip is still contaminated after several cleaning attempts using the wet cleaning technique, call Coherent Technical Support as follows:
   - By email: customer.support@coherent.com
   - By phone: +**1 (734) 456-3100**

4 SOFTWARE INSTALLATION

4.1 Overview

This section describes how to set up and install the Coherent Connection software and related drivers for the OBIS Laser system. Software installation is optional and provides additional functionality that is not available with other methods of laser control.

Coherent Connection software supports the following laser products: OBIS LX, OBIS LX-SF (Single-Frequency), OBIS LS, OBIS CORE LS, OBIS LG, OBIS XT, OBIS CellX, StingRay, and BioRay.

Coherent product information and related software is available in one easily accessible location on the Coherent website. To download, go to:
https://www.coherent.com/resources

For more information about use of Coherent Connection software, refer to “Coherent Connection Software” (p. 69).

4.1.1 Remote Control via USB or RS-232

To install Coherent Connection software, the OBIS laser system must first be connected to a workstation (personal computer or laptop) with a USB cable or a standard DB9F RS-232 connection.

- The USB cable is included in the OBIS Laser System.
- The RS-232 cable is a standard PC serial cable (not included with the laser).

If not connected, connect a standard serial cable from he back of the OBIS Remote or OBIS Laser System to the host workstation (PC or laptop). Refer to “Step 7: Connect USB/RS-232 (optional)” (p. 51).

NOTICE

When installing Coherent Connection, the driver is automatically loaded onto the host computer as part of the installation process.

4.1.2 System Requirements

It is recommended that you use the most current and robust systems possible. Support for the OBIS laser system is provided on Windows v10 (32- and 64-bit) operating systems: In addition, the workstation must meet the following minimum requirements:

- 512 MB of RAM
- Microsoft .NET Framework 4.0 or higher. If no version (or an older version) is found on the workstation, then the installation program installs a version of Microsoft .NET Framework.
- USB or RS-232 port

4.1.3 Software Installation Procedure

NOTICE

Before you install Coherent Connection software, it is recommended that you first close all other applications. The installation requires that you restart the workstation when installation is complete.

To install the Coherent Connection software and related drivers:

1. Coherent product information and related software is available in one easily accessible location on the Coherent website.

   Go to Coherent.com/Resources to search for and download the software:

   https://www.coherent.com/resources

2. Close all programs.
3. Double-click the following file to start the installation process. The last two digits represent the number for the current software build. Example filename:

   `Coherent_Connection_Setup_v5.0.x.xx`

   The following message is displayed. Available languages include English, Italian, French, German, Hebrew, and Japanese. Note that the language selection applies only to software set-up instructions on-screen, and not to the Coherent Connection software itself (available in English only).
4. From the drop-down menu shown in Figure 4-1, select the language in which to display the software and click OK.
5. If you had previously installed the Coherent Connection software, the message shown in Figure 4-2 is displayed. Click Yes to proceed.

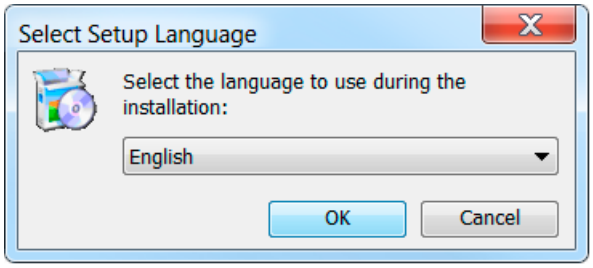


Figure 4-1. Select Language for Software

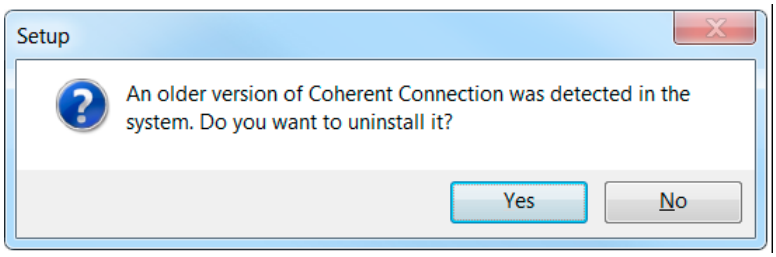


Figure 4-2. Uninstall Old Version of Software

6. An example of the Welcome screen shown in Figure 4-3 is displayed.

Figure 4-3. Welcome Screen for Installation

7. Read the instructions, then click Next. The License Agreement shown in Figure 4-4 is displayed.
8. Scroll down to read the agreement. Note that the Next button is grayed out until you click the radio button to **Accept** the terms and conditions. When you do that, the button is activated; click Next.

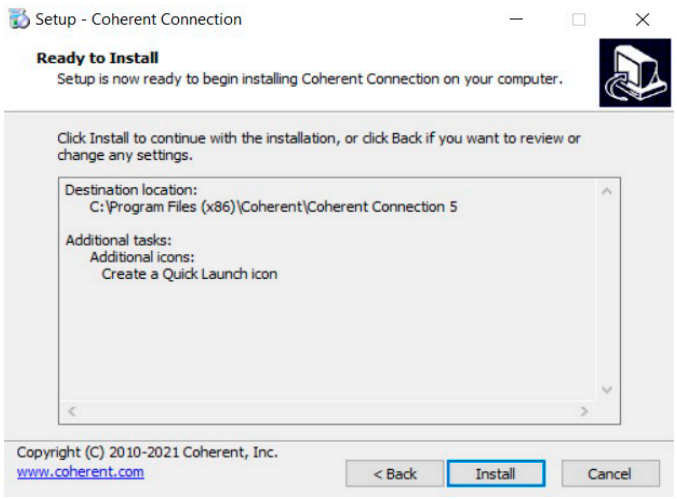


Figure 4-4. Coherent Connection 4 License Agreement

9. The window shown in Figure 4-5 is an example of what is displayed. Accept the selection, or browse to select the directory on the workstation where you want to install the software, and click Next.

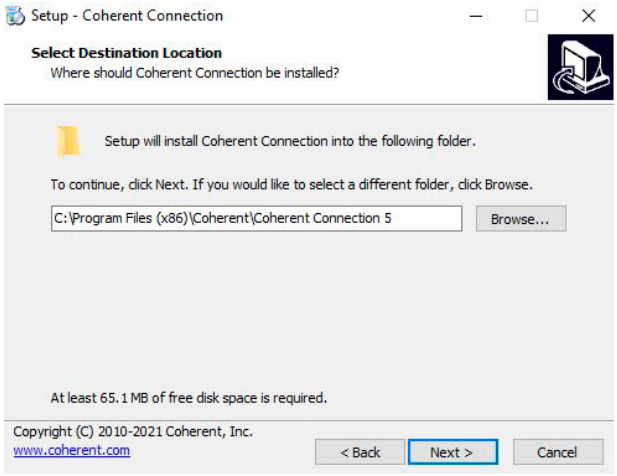


Figure 4-5. Select Directory to Install Software

10. You can create an icon for the software either on your desktop or for a Quick Launch (or both). As shown in Figure 4-6, click the appropriate check box, and then click Next.
11. The set-up utility is now ready to begin installing Coherent Connection 4 software on your workstation. Review the location and icons, as shown in the example in Figure 4-7, and then click Next.

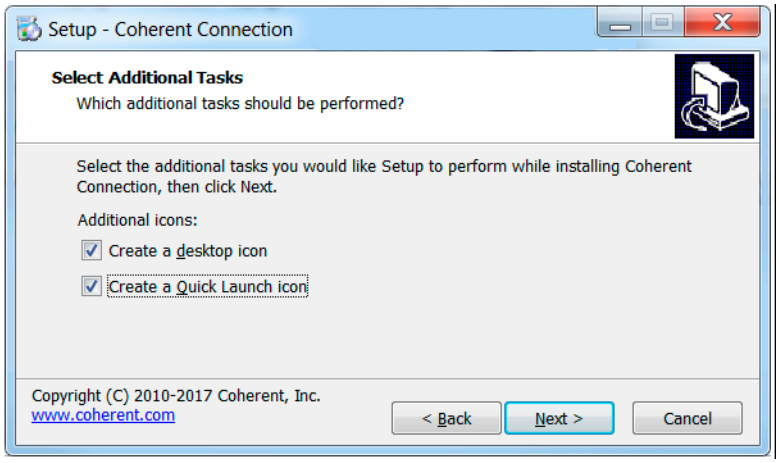


Figure 4-6. Set Desktop or Quick Launch Icon

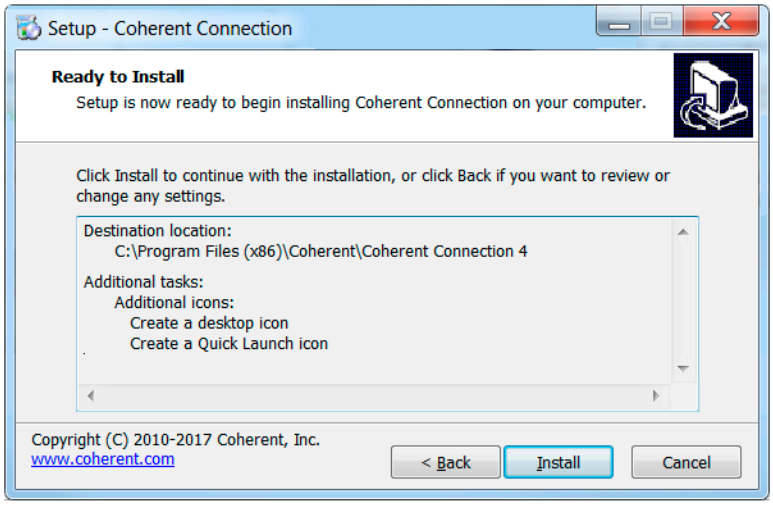


Figure 4-7. Review Set-Up before Installation Begins

A progress bar is displayed, as shown in Figure 4-8.

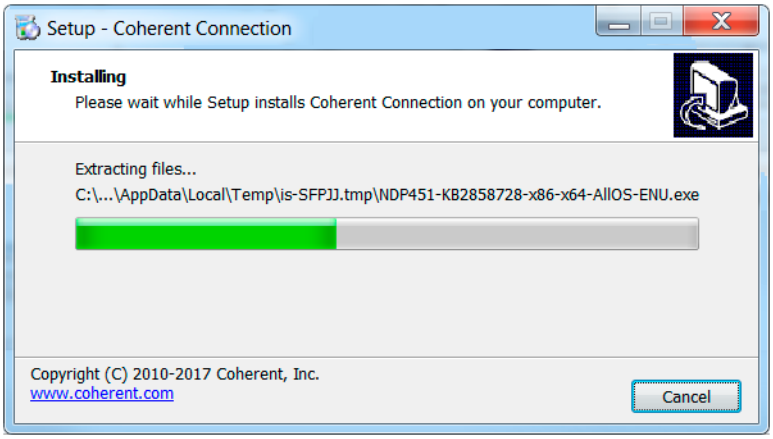


Figure 4-8. Progress of Installation

12. During the installation process, some files are extracted, as shown in the example in Figure 4-9.

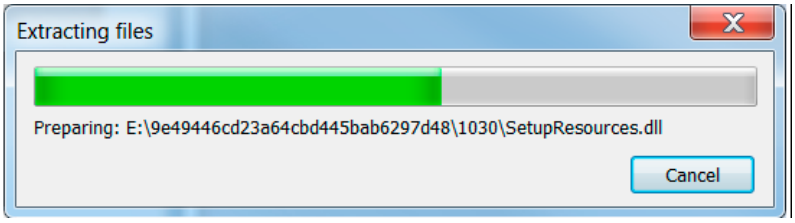


Figure 4-9. Extracting Files

13. After all files are extracted, click Finish. A screen like the one shown in Figure 4-10 closes and the software is ready to be launched.

Figure 4-10. Finish the Software Installation

The software and USB driver are now installed.

If a short-cut (icon) was selected to be set up during installation, that is now displayed on the desktop of your workstation and/or in the Quick Launch menu, as shown in Figure 4-11:

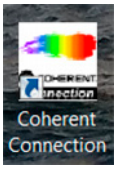


Figure 4-11. Desktop Icon for Coherent Connection Software

5 COHERENT CONNECTION SOFTWARE

This section provides an overview of the Coherent Connection software.

Coherent Connection software supports the following laser products: OBIS LX, OBIS LX-SF (Single-Frequency), OBIS LS, OBIS CORE LS, OBIS LG, OBIS XT, OBIS CellX, StingRay, and BioRay.

Coherent product information and related software is available in one easily accessible location on the Coherent website. To download, go to:
https://www.coherent.com/resources

Through this software, users can control laser power or other parameters directly through a USB or RS-232 connection.

- Remote control via USB and RS-232 (p. 69)
- Coherent Connection software (p. 70)

For information about using a terminal program, see “OBIS Communications via a Terminal Program” (p. 106).

5.1 Remote Control via USB or RS-232

Through the Coherent Connection software, laser power or other parameters can be controlled directly through a USB or RS-232 connection.

- USB and RS-232 use the same syntax, commands, and queries.
- When both USB and RS-232 are connected to the OBIS Remote, the USB overrides the RS-232.

For information about RS-232 pin-out or communication settings, see Part II of the *OBIS LX/LS Operator’s Manual)*.

The OBIS USB driver allows communication with the OBIS using a terminal program or a custom-developed program. The driver creates a virtual OBIS COM device in the host computer that gives access to its controls.

NOTICE

When installing Coherent Connection software, drivers are automatically loaded onto the host computer as part of the installation process.

Connectors for a USB or RS-232 cable are located on the back panel of an OBIS Remote. A USB connector is located on the back panel of the OBIS laser. Refer to Figure 2-7.

If not connected, connect the OBIS Remote or OBIS Laser System to the host workstation (PC or laptop). Refer to "Step 7: Connect USB/RS-232 (optional)" (p. 51).

NOTICE

When OBIS laser system is connected directly to the workstation, DO NOT make a connection to the USB connector on the back panel of a OBIS Remote. Instead, the connection must be made to the USB connector on the OBIS *Laser*.

5.2 Coherent Connection Software

Coherent Connection provides an easy-to-use interface between a Coherent OBIS Laser or mini-controller and a PC.

Coherent Connection software lets a user set modes, change laser output power, and get laser status and information in its graphical user interface (GUI). The software supports both OBIS LS and OBIS LX lasers.

This section introduces the main tabs in the software.

To access complete operating instructions, open the Coherent Connection software and click **Help**.

- Click on the icon for the Main menu to display the options in the drop-down menu.
- Click the Help icon to display the embedded Help file.

The Help menu option is shown in Figure 5-1.

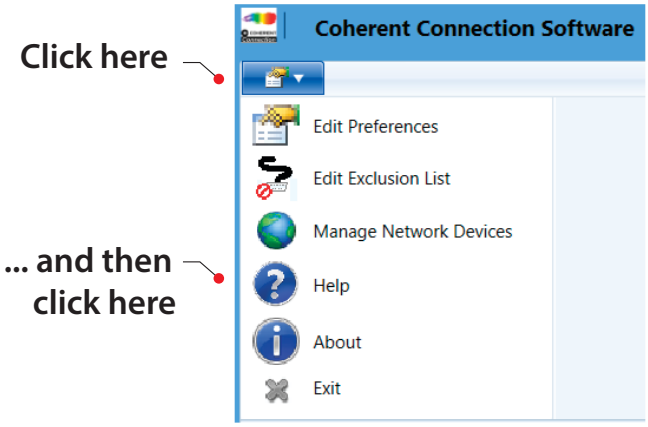


Figure 5-1. CCoherent Connection HELP Menu Option

5.3 Overview of the Main Tabs

This section provides a brief description of each of the tabs in the Coherent Connection software.

Figure 5-2 shows the Operating Power tab. On this page of the software, you can set power levels.

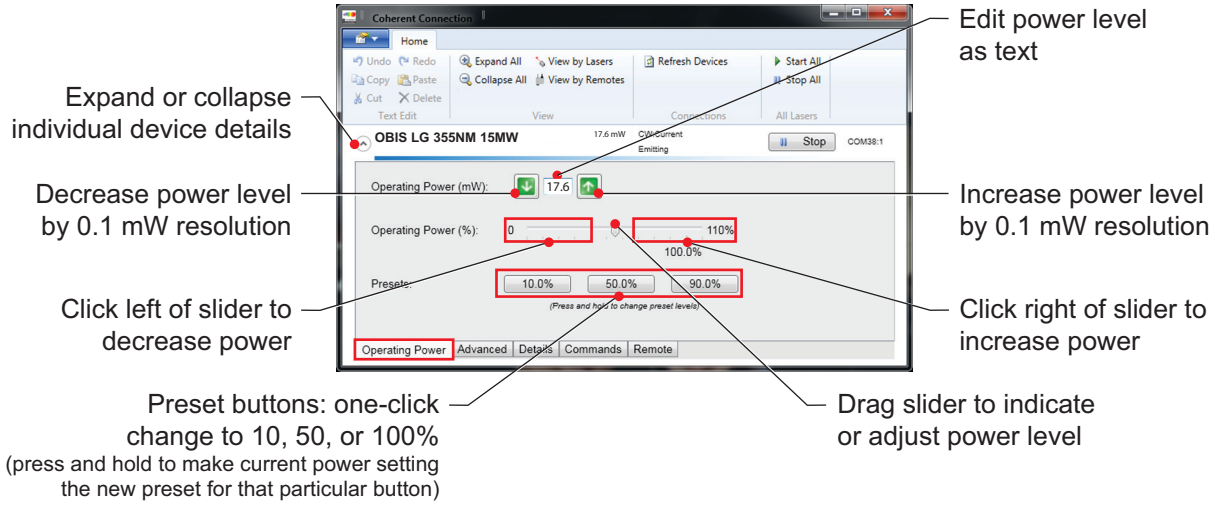


Figure 5-2. Coherent Connection - Operating Power Tab

Figure 5-3 shows the Advanced tab. On this page of the software, you can select the Operating mode, enable or disable the CDRH delay, Auto Start, Blanking, as well as reset the laser or factory calibration settings Note that recalibration requires the laser to be updated to the most current firmware.,

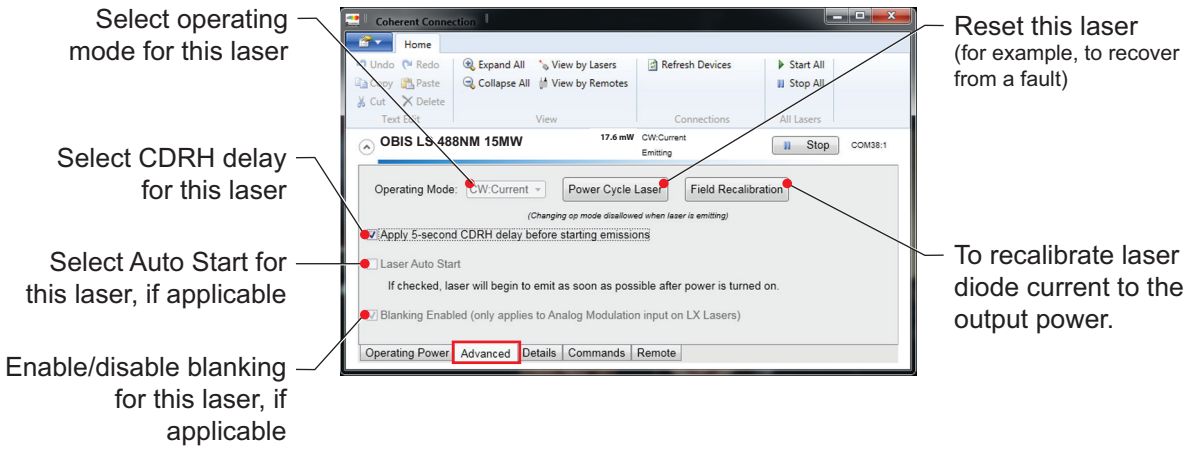


Figure 5-3. Coherent Connection - Advanced Tab

Figure 5-4 shows the Details tab. On this page of the software, you can view the model, serial number, and other information specific to the laser.

Information on this tab is specific to the currently-selected laser.

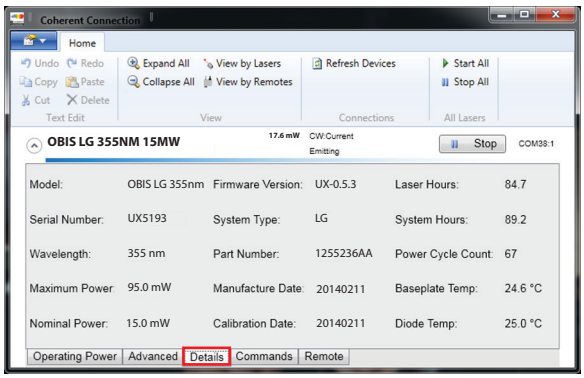


Figure 5-4. Coherent Connection - Details Tab

Figure 5-5 shows the Commands tab. You can view commands and responses, or enter commands to control the laser.

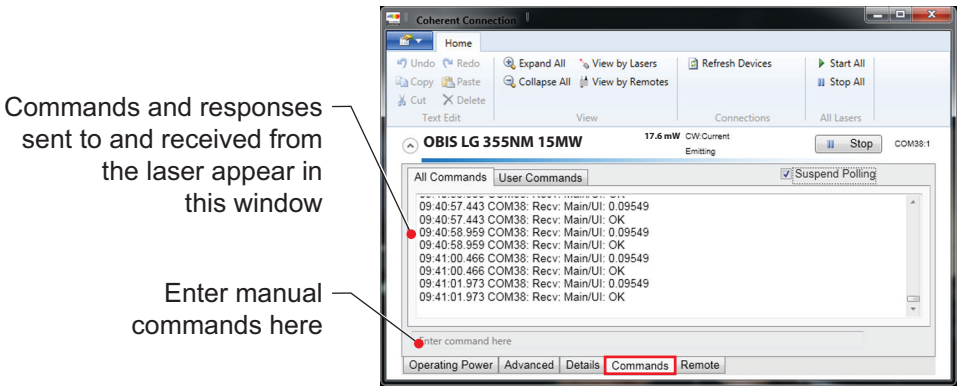


Figure 5-5. Coherent Connection- Commands Tab

Figure 5-6 shows the Remote tab. On this page of the software, you can enable settings to start all lasers on power-up, as well as select the input impedance for Analog Modulation mode.

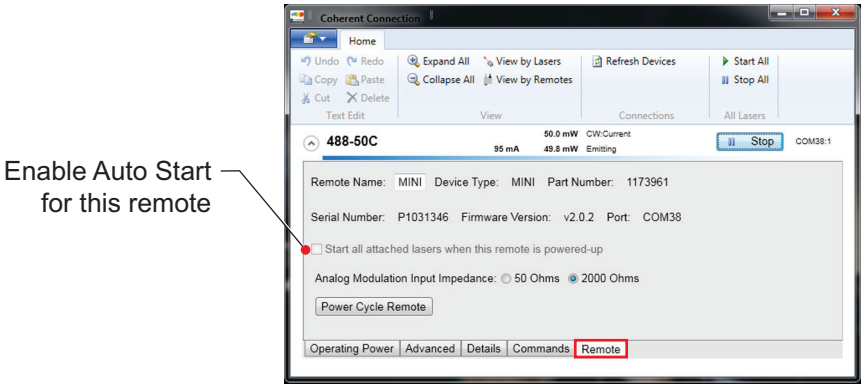


Figure 5-6. Coherent Connection - Remote Tab

5.3.1 OBIS LX Single-Frequency and Coherent Connection

To fine-tune the OBIS LX-SF laser's wavelength, use the Power tab as shown in Figure 5-7 to do the following:

NOTE: This feature is only available for LX-SF laser models.

- Adjust the diode temperature.
- Adjust the diode current by adjusting the operating power.

- Or a combination of both.

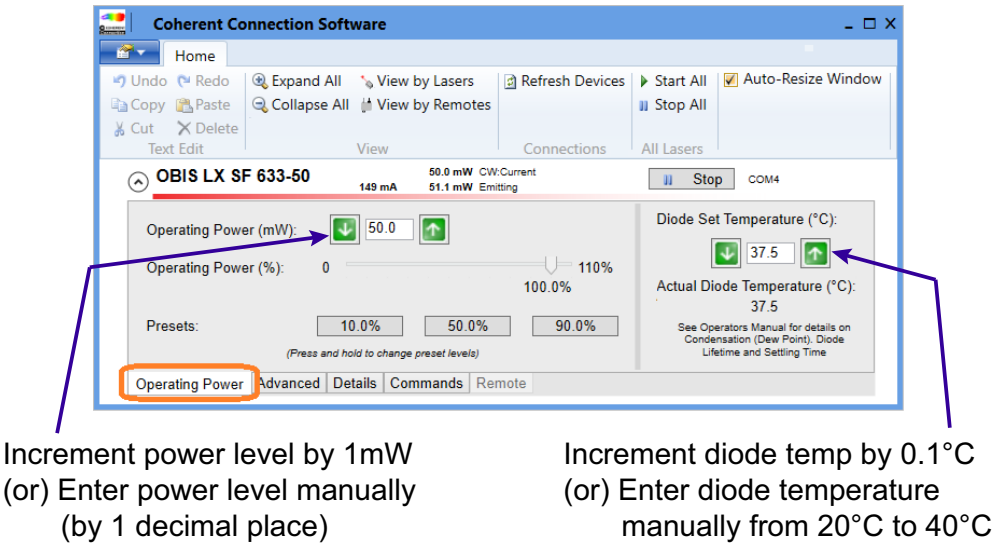


Figure 5-7. OBIS LX-SF Tune Wavelength

NOTICE

Ensure that the laser is set to operate in 'CW:Current' (constant current mode).

Figure 5-8 shows the emission status of the laser.

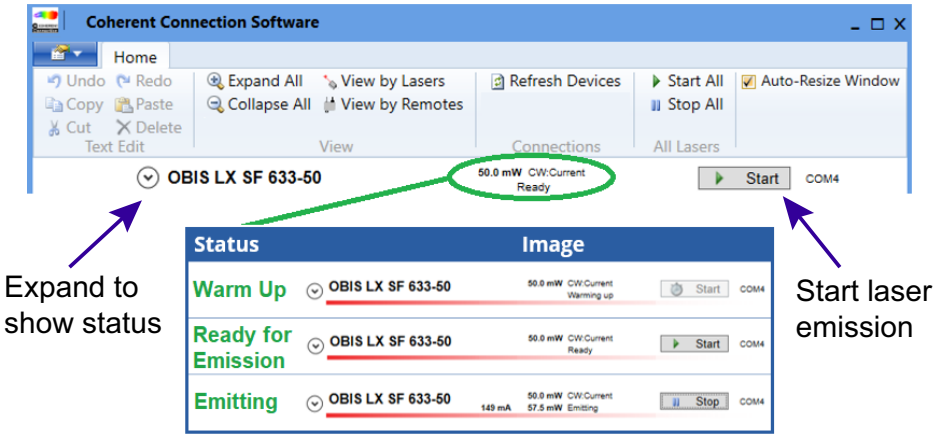


Figure 5-8. OBIS LS-SF Emission Status

6 OPERATION

OBIS lasers offer a wide range of operating modes for modulation and variable power control. This section includes:

6.1 Introduction

The OBIS Laser System operates in a variety of modes. This section of the manual covers the use of the OBIS Remote and Laser in either Continuous Wave (CW) or Modulation mode.

To view short video presentations about OBIS LX/LS Modulation Modes, go to YouTube and search for OBIS Laser videos.

6.2 Hardware Set-Up

Normal operation of the OBIS Remote assumes the following initial configuration steps are complete:

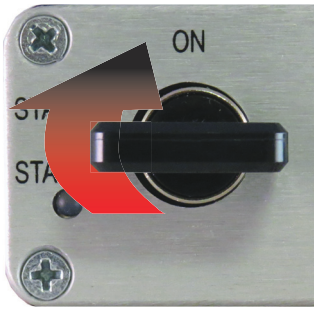
1. Applicable laser safety control measures are set up—refer to “Appendix - Laser Safety” (p. 125) for laser safety information.
2. The laser is mounted with the correct heatsink and torque specifications—refer to “Step 1: Install the Heatsink” (p. 43) for heatsink and torque requirements.
3. The SDR interface cable is connected between the laser and the OBIS Remote (if remote is used in configuration).
4. The main power switch on the OBIS Remote is in the OFF (“0”) position.

5. The keyswitch on the OBIS Remote is in the STANDBY position.
6. The interlock jumper on the OBIS Remote is inserted (closed).
7. The power supply cable is connected to the OBIS Remote (do not connect the power supply cable to the laser).

CAUTION!
Optics or objects in front of the laser can reflect a part of the beam back into the laser. This event—known as *back reflection*—can cause instability, noise, or laser damage. Refer to "Appendix - Laser Back Reflection" (p. 147) for more information.

6.3 Normal Start-Up

1. Toggle the OBIS Remote power switch to the ON position. The Status LED on the laser flashes green at 2.5 Hz, which shows that the laser is in warm-up mode.
2. Wait until the Status LED on the laser turns blue. The laser completes its warm-up mode and goes into STANDBY mode.



3. Insert the OBIS Remote keyswitch and turn it to the ON position to start laser emission. Laser emission occurs after the keyswitch is set to the ON position. The Status LED on the laser turns white and remains white when the laser emission is ON.
4. After safe laser beam control is ensured, move the laser shutter to the OPEN position, as indicated on the laser top label.

6.3.1 Operating Modes

The OBIS Laser System offers the following operating modes:

Continuous Wave (CW)

- Constant power (p. 79)
- Constant current (*LX version only*) (p. 80)

- Power control through analog modulation (p. 82)

Pulsed

- Analog modulation (Analog:Power for OBIS LX) (p. 84)
- Digital modulation (p. 91)
- Digital current (*LX version only*) (p. 94)
- Mixed modulation (p. 95)

Table 6-1 lists the various modes for OBIS LX and OBIS LS lasers.

Table 6-1. OBIS Modulation Types for LX and LS

Modulation Feature	OBIS LX	OBIS LS
Constant Power, power control[a]	CW:Power	CW Power
Constant Current, current control[b]	CW:Current	N/A
Analog Modulation, power control	Analog:Power	Analog Modulation
Digital Modulation, power control	Digital:Power	Digital Modulation
Digital Modulation, current control	Digital:Current	N/A
Mixed Modulation, power control	Mixed:Power	Mixed Modulation
Mixed Modulation, current control	Mixed:Current	N/A

a. Power Control = Light Regulation
b. Current Control = Current Regulation

6.3.2 CW-Only-Mode Versions for OBIS LX Lasers

If the OBIS LX laser is a CW-Only-Mode laser and/or the Serial Number has ‘CW’ in the number, then the laser is intended to be operated only in the CW-Power mode or CW-Current mode.

CAUTION!
If using a CW-Only-Mode laser, then:
*** Do *not* operate the laser in Analog Modulation Mode!**
*** Do *not* operate the laser in Digital Modulation Mode!**
*** Do *not* operate the laser in Mixed Modulation Mode!**

If the CW-Only-Mode laser is set to a Modulation Mode, the laser output power could be a maximum of 110%.

NOTICE
The customer-provided modulation input signals will not change the potential maximum 110% output power condition when laser emission is enabled.

CW-Only-Mode laser can be operated as described in this Operator's Manual with Coherent Connection, an OBIS Remote, or USB communication to turn the laser ON and OFF to control emissions.

6.4 CW:Power Operation

NOTICE
The system is delivered in CW:Power mode. Operating in other modes requires USB or RS-232 remote control from a computer running either Coherent Connection software or a terminal program (such as Windows HyperTerminal).

OBIS LX and LS lasers can be operated in a continuous wave (CW) operating mode.

1. Start the Coherent Connection Software.

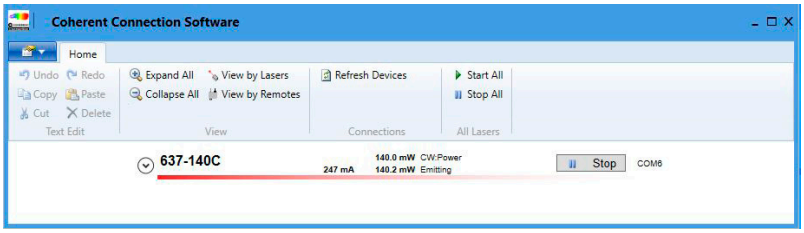
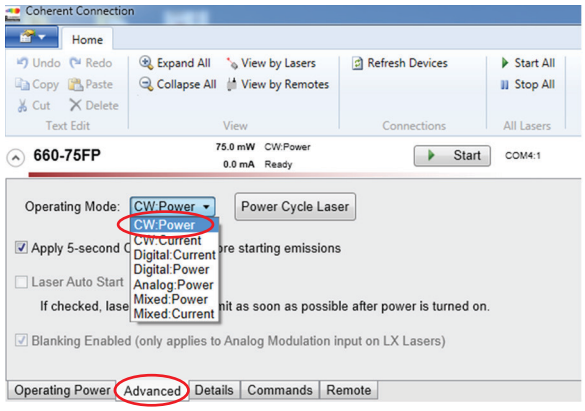


Figure 6-1. Select Operating Mode

2. Attach the communication cable to the laser. The software beings the autofind process to identify the connected laser. Refer to Figure 6-1.
3. Select the operating mode for OBIS LX and LS lasers from the Advanced tab in the Coherent Connection user interface. Figure 6-2 shows the menu options for both the OBIS LX and the OBIS LX lasers.

OBIS LX



OBIS LS

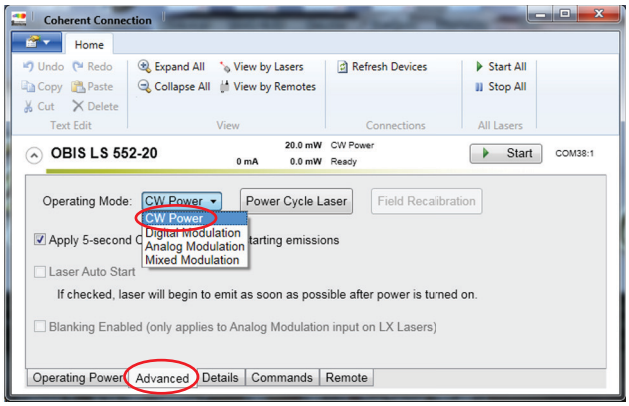


Figure 6-2. Select Operating Mode

6.4.1 CW Operation Constant Power

OBIS LX and LS lasers are configured in CW:Power operating mode as default. OBIS LX lasers have a CW:Current operating mode option—refer to “CW Operation Constant Current (OBIS LX only)” (p. 80) for information about the CW:Current operating mode.

OBIS lasers have a closed light loop circuit, internal to the laser, that operates the laser in a Constant Power mode. This operating mode is called *CW:Power*.

In either CW:Power or CW:Current modes, the laser output is adjusted through the user interface to change the output power level. As shown in Figure 6-3, use the Coherent Connection software to do one of the following:

- Select the output power by typing in a value, or
- Adjust the power slide control, or
- Select a preset.

OBIS LX and OBIS LS

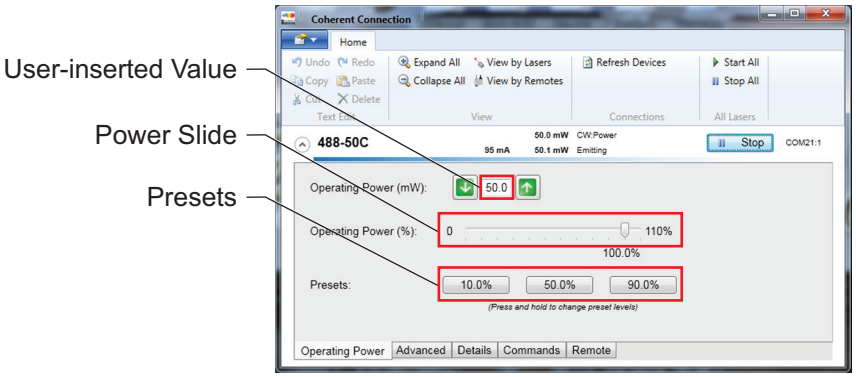


Figure 6-3. Select Output Power Level

6.4.2 CW Operation Constant Current (OBIS LX only)

Operating the OBIS LX laser in Constant Current mode requires initialization through Coherent Connection software or a terminal program.

OBIS LX lasers can be selected to operate in a CW:Current mode that does not use the closed light loop. In CW:Current mode, the laser operates with a constant current drive to the laser diode.

1. Make sure that the laser is in **Stop** mode.
2. In the Coherent Connection software, go to the **Advanced** tab and select *CW Current* mode in the *Operating Mode* drop-down menu, as shown in Figure 6-4.

OBIS LX

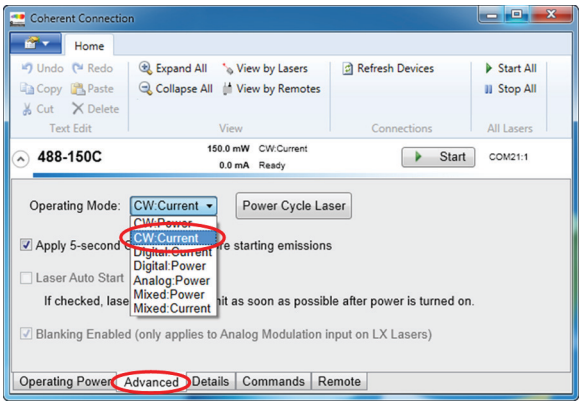


Figure 6-4. Select CW:Current Mode

3. Click the **Start** button. The laser will turn ON after a 5-second delay.

4. With the Coherent Connection software, set the laser output power by doing one of the following:
   - Move the power slide control, or
   - Select one of the three power preset buttons, or
   - Type in a value.

6.4.2.1 Current Modes for OBIS LX Field Calibration

As the laser diode (OBIS LX) ages, the diode will require more operating current to maintain the same output power. Use *Field Recalibration* to reset the operating-current-to-output-power relationship.

Field calibration applies only to these operating modes:

- CW:Current
- Digital:Current
- Mixed:Current

NOTICE

Field Recalibration requires the output power to be set at 100% for this process.

To recalibrate the laser diode current to the output power, use the Field Recalibration Command, shown in Figure 6-5.

OBIS LX

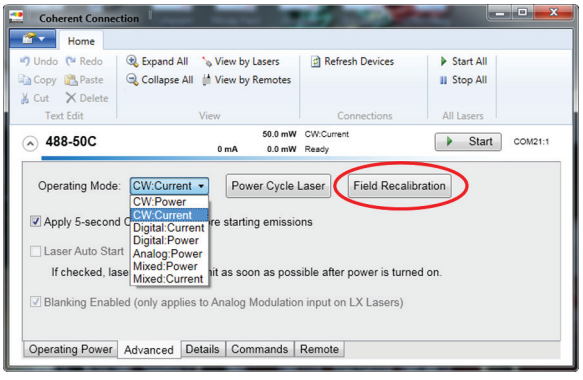


Figure 6-5. Field Calibration Button

Refer to “Field Recalibration Command for OBIS LX” (p. 97).

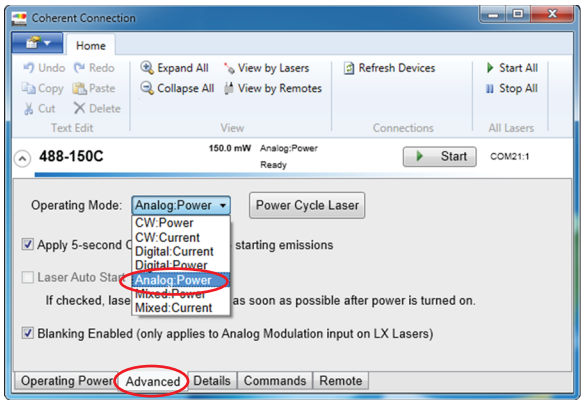
When using a terminal program, refer to "OBIS Communications via a Terminal Program" (p. 106).

6.4.3 Analog Modulation

The OBIS Laser System provides the capability to control the output power with an external DC voltage source. To start this operation mode:

1. Start the Coherent Connection software program.
2. On the Advanced tab in the *Operating Mode* drop-down menu, shown in Figure 6-6, select:
   - OBIS LX: *Analog:Power*
   - OBIS LS: *Analog Modulation*

OBIS LX



OBIS LS

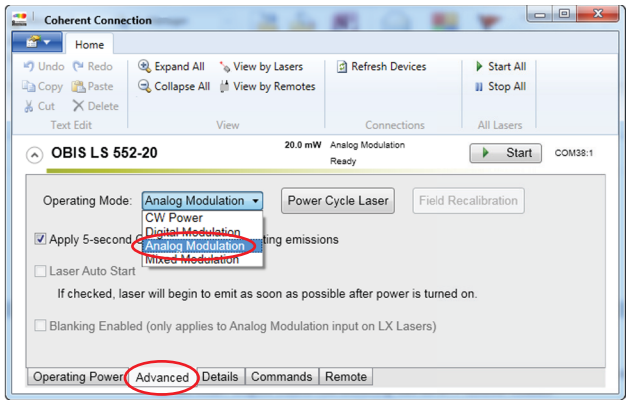


Figure 6-6. Power Control through Analog Modulation

3. Select the Analog Modulation Impedance *(50 Ohms* or *2000 Ohms*) from the Remote tab. This selects the input impedance of the remote.
4. Apply the analog voltage (0 to 5.0V) through the Analog SMB connector on the back of the OBIS Remote. The laser power adjusts from minimum to 110%, with a corresponding analog voltage from 0 to 5V.

OBIS LX and OBIS LS

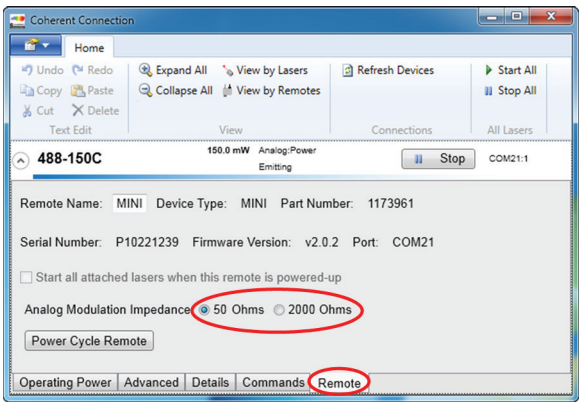


Figure 6-7. Select Impedance

6.5 Modulation Modes

The OBIS Laser System provides the capability of CW or pulsed laser emission. The pulsed output must be controlled with external analog or digital signals (or both).

To view short video presentations about OBIS LX/LS Modulation Modes, go to YouTube and search for OBIS Laser videos.

6.5.1 CW-Only-Mode Versions for OBIS LX Lasers

If your OBIS LX laser is a **CW-Only-Mode** laser and/or the Serial Number has ‘CW’ in the number, then the laser is intended to be operated only in the CW-Power mode or CW-Current mode.

CAUTION!
When a CW-Only-Mode laser is used, then:
*** Do *not* operate the laser in Analog Modulation Mode!**
*** Do *not* operate the laser in Digital Modulation Mode!**
*** Do *not* operate the laser in Mixed Modulation Mode!**

If the CW-Only-Mode laser is set to a Modulation Mode, the laser output power could be a maximum of 110%.

NOTICE

The customer provided modulation input signals will not change the potential maximum 110% output power condition when laser emission is enabled.

CW-Only-Mode laser can be operated as described in this Operator's Manual using Coherent Connection, an OBIS Remote, or USB communication to turn the laser ON and OFF to control emissions.

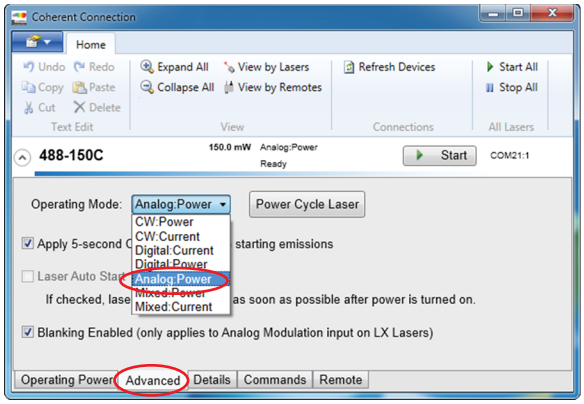
6.5.2 Analog Modulation (OBIS Remote)

OBIS lasers offer Analog modulation that allow the laser output power to track an analog input voltage.

Analog modulation can be used with a DC voltage source to change the output power. Also sine wave, triangle wave or any arbitrary waveform can be used to control the laser power by tracking the input voltage.

In the Coherent Connection software program, select *Analog Modulation* (for OBIS LS) or *Analog:Power* (for OBIS LX) from the *Operating Mode* drop-down menu. If you are using a terminal program, refer to "OBIS Communications via a Terminal Program" (p. 106).

OBIS LX



OBIS LS

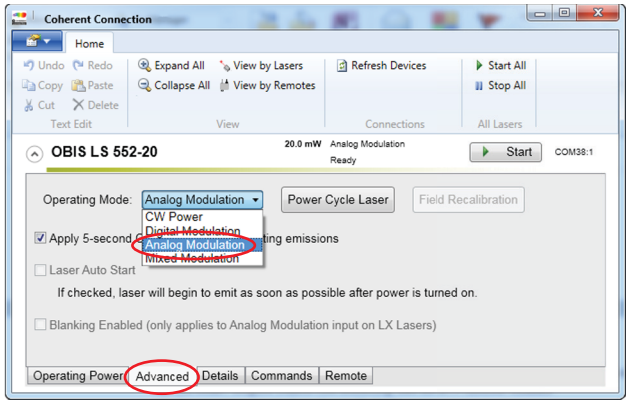


Figure 6-8. Select Analog Modulation

Modulation signals are connected to the back of the OBIS Remote through the SMB connectors, shown in Figure 6-9. There are separate Modulation Input connectors for:

- Analog modulation

- Digital modulation.

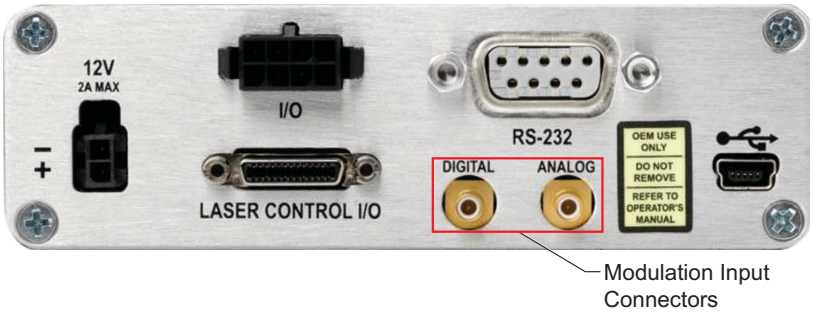


Figure 6-9. Select Modulation Input Connector

The Analog Modulation Impedance can be set at either 50 or 2000 Ohms. This option is available in the Remote tab of the Coherent Connection application software. Note that with 50 Ohms and 5 Volts the signal will need to be able to drive a 100 ma load. Choose 2000 Ohms for signal generators that can only supply 2.5 mA of current.

The Analog modulation input voltage is controlled from 0 to 5 volts. At 0 volts the laser is at minimum output power. With 5 volts input, the laser is at 110% of its rated output power, as shown in the graph in Figure 6-10.

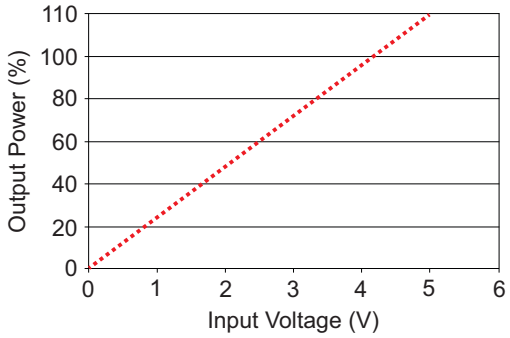


Figure 6-10. Analog Modulation Power vs. Analog Modulation Input Voltage

The OBIS LX also offers *Blanking Enabled*, which lets the Analog input turn the laser to minimum output power. With Blanking Enabled the lower input voltages drive the laser completely off.

The OBIS Laser can be controlled with the Analog input to:

- Vary the output power
- Modulate with an arbitrary waveform

- With a square wave of different voltage levels, be able to control the laser with different output power levels

Blanking is enabled/disabled (*OBIS LX only*) on the Advanced tab of Coherent Connection, shown in Figure 6-11.

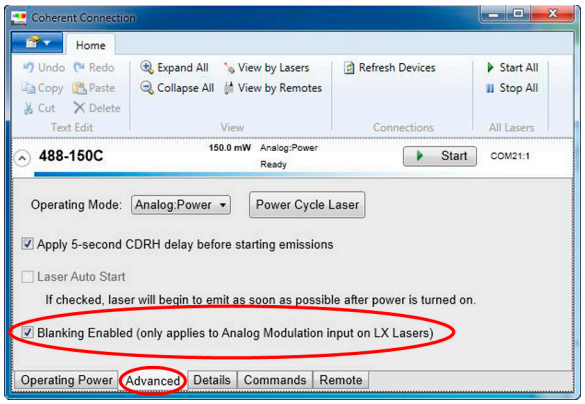


Figure 6-11. OBIS LX – Enable/Disable Blanking

Blanking is used to turn the diode to minimum output power. If not used, the diode remains on but is below lasing threshold, shown in Figure 6-12

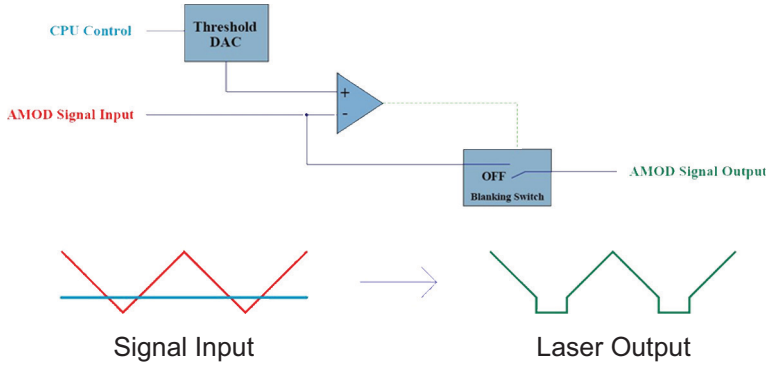


Figure 6-12. OBIS LX – Analog Modulation Blanking Circuit Diagram

6.5.2.1 Analog Modulation (LVDS Voltage at OBIS SDR Input)

Modulation inputs that control the laser output power are on pins 11 and 24 of the OBIS Laser SDR connector. These inputs are **L**ow **V**oltage **D**ifferential **S**ignals (LVDS).

The OBIS analog input circuits use a two-wire differential input circuitry that has a voltage swing of -0.930 to 0.930 VDC and an input resistance of 100 ohms.

An advantage of differential signaling is that it offers common mode rejection. The receiver ignores any noise that is coupled equally on to the differential signals and only considers the difference between the two signals.

Table 6-2 lists the electrical characteristics of the analog input.

Table 6-2. Analog Input Electrical Characteristics

Parameter	Test Conditions	Min	Typ	Max	Unit
Absolute maximum differential analog input at SDR connector	[a]			+ 1.00	V
Absolute minimum differential analog input at SDR connector	a	- 1.00			V
Impedance between Pin 24 and Pin			100		Ohms
Maximum laser power	Vdiff = 0.930V[b]	104	110		%
Half power	Vdiff = 0.0V[b]	52	55	58	%
Minimum laser power (OBIS LX with Blanking enabled)	Vdiff = - 0.930V		0	0	%
Default threshold level			1		%
Common mode analog input at SDR connector	[c]	0		4	V

a. Pin 11 compared to Pin 24.
b. Vdiff = differential analog input at the SDR connector of the laser, which is Pin 11 compared to Pin 24.
c. A common mode voltage outside of the recommended range will cause clipping of the differential analog input and the laser may not reach the desired power.

Figure 6-13 provides an example of a Sine Wave Input/Output.

Figure 6-14 displays an example of Minimum Power.

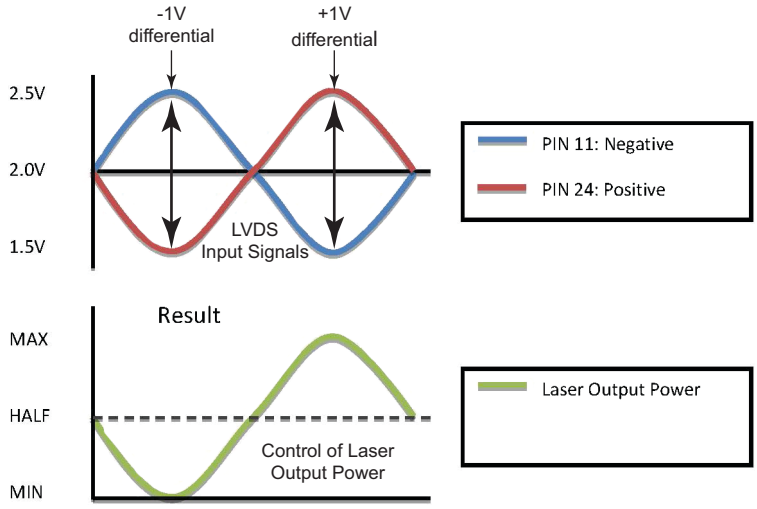


Figure 6-13. Example of Sine Wave Input/Output

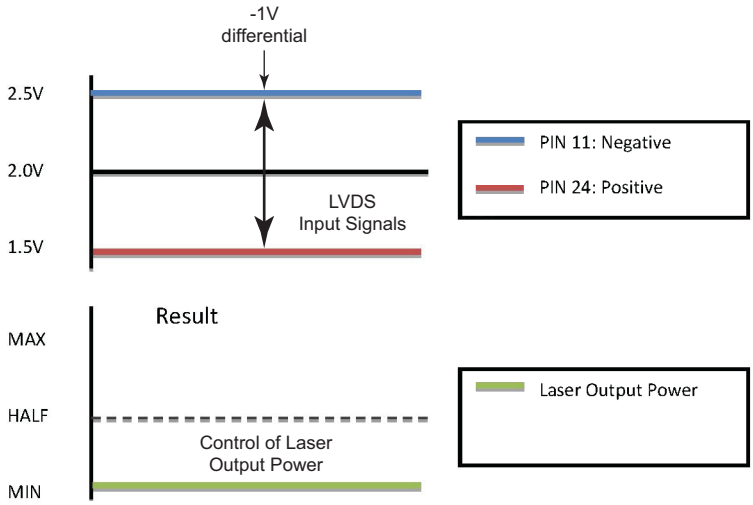


Figure 6-14. Example of Minimum Power

NOTICE

Without an input signal on pins 11 and 24, the system operates at 55% power, which is the common mode function.

6.5.2.2 OBIS Modulation Input Voltage Levels

Table 6-3 shows the Analog Modulation Input Voltage levels and the related laser output power.

Table 6-3. OBIS Modulation Input Voltage Levels

Description	Explanation	Voltage at OBIS Remote SMB Input	LVDS Voltage at OBIS Laser SDR Input	Laser Output Power for a 405 nm LX 55 mW	Laser Output Power for a 561 nm LS 50 mW
Analog Modulation Maximum Power	110% of Nominal Power	5.0V	0.930V	60.5 mW	55 mW
Analog Modulation Nominal Power	100% of Nominal Power	4.55V	0.760V	55 mW	50 mW
Analog Modulation Threshold (OBIS LX only)	Threshold (Blanking) Level	≤ 0.0248 V	≤ -0.922V	≤ 0.3 mW	Not Appli-cable
Analog Modulation Minimum Power	Minimum Power	0.0V	-0.930V	0 mW with Blanking Enabled	< 1 mW

6.5.2.3 Modulation Waveform Definitions

The next three figures show a typical modulation pulse. These examples represent an OBIS 405 nm LX 55 mW with blanking level at 0.3 mW.

Figure 6-15 displays the pulses for the maximum power and the minimum power output.

Figure 6-16 displays the Rise Time for the Modulation Pulse.

Figure 6-17 displays the Fall Time for the Modulation Pulse.

Figure 6-18 shows typical waveforms under analog modulation. In this example, the analog signal is a 0 to 5V, 50 kHz, square wave.

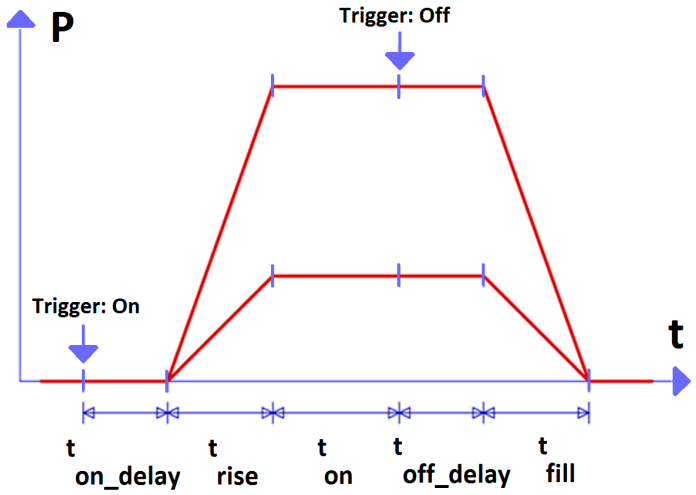
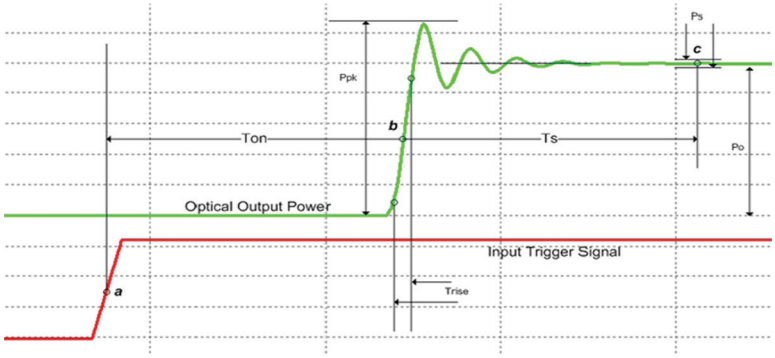
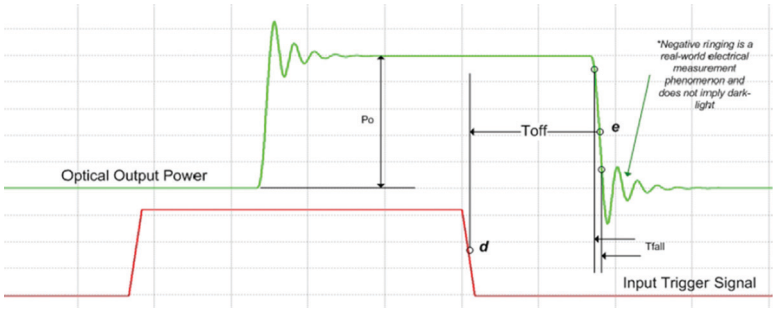


Figure 6-15. Maximum Power and Minimum Power Output Pulse



a & d = 50% of input trigger signal
b & e = 50% of Po
Ton = T(b) - T(a)
Trise = T(0.1 *Po) - T(0.9 *Po)
Setting time T(s) to 1% = T(c) - T(b) ;***where Ps/Po *100 = 1%***
Overshoot(%) = (Ppk-Po)/Po *100

Figure 6-16. Modulation Pulse, Rise Time



a & d = 50% of input trigger signal
b & e = 50% of Po
Toff = T(d) - T(e)
Tfall = T(0.9 *Po) - T(0.1 *Po)

Figure 6-17. Modulation Pulse, Fall Time

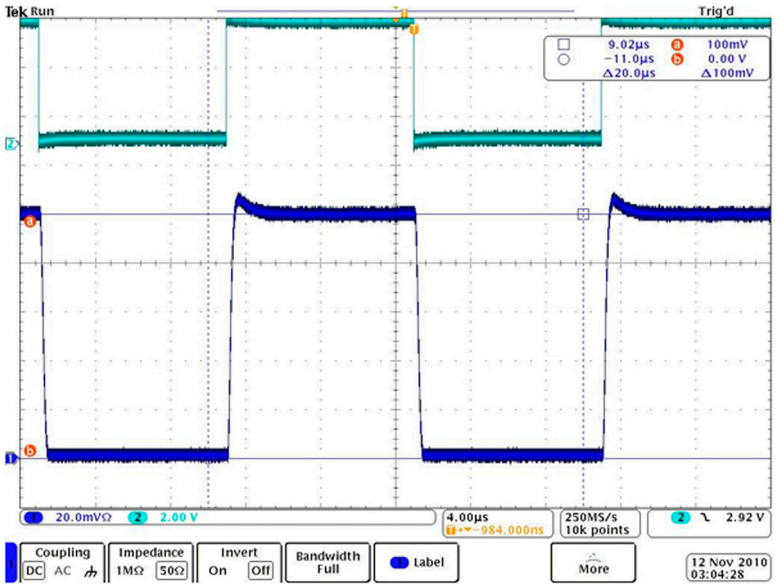


Figure 6-18. Typical Waveforms under Analog Modulation

6.5.3 OBIS Digital Modulation Input Voltage Levels

For applications requiring a laser to turn ON and OFF in a Digital mode, OBIS lasers offer Digital modulation. OBIS lasers can be modulated in the Digital modes from minimum power to the Set Power. Table 6-4 lists the various digital modulation input voltage levels.

Notes:

- When operating in Digital Modulation mode at the OBIS Remote SMB input, the voltage input signal needs a minimum 30 mA drive current

Table 6-4. OBIS Digital Modulation Input Voltage Levels

Digital Mode	Power	Voltage at OBIS Remote SMB Input	LVDS Voltage at OBIS Laser SDR Input	Laser Output Power
ON	Set Power	> 1.5 VDC	ON: Vdiff > 0.05 VDC	Set Power
OFF	Minimum Power	< 1.0 VDC	OFF: Vdiff < -0.05 VDC	OBIS LS at 0 mW OBIS LX at Rated Output Power divided by 1,000,000 at 0 Hz

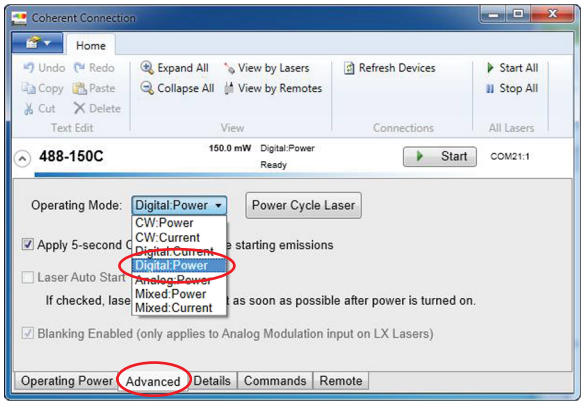
capability into 50 ohms with the OBIS Remote. Computer I/O DAQ products frequently do not provide an output which can drive a 50 ohm load. In those instances, use an additional line driver intended for use with I/O hardware with TTL/CMOS outputs to provide the 50 ohm Digital Modulation drive requirement.

- A minimum 5 mA drive capability is required when using LVDS voltage at the OBIS Laser SDR input. When operating in Digital Modulation mode using LVDS, laser emission is ON when Digital(+) > 0.05 VDC higher than Digital(-) and OFF when Digital(+) is more than 0.05 VDC lower than Digital(-).

Users can adjust the Set Power through Coherent Connection (or host interface) to allow the "ON" level for Digital Modulation to be adjustable. If you are using a terminal program, refer to "OBIS Communications via a Terminal Program" (p. 106).

Choose *Digital Modulation* from the *Operating Mode* drop-down menu on the Advanced tab of the Coherent Connection software program. Figure 6-19 shows the menus for both OBIS LX and OBIS L.

OBIS LX



OBIS LS

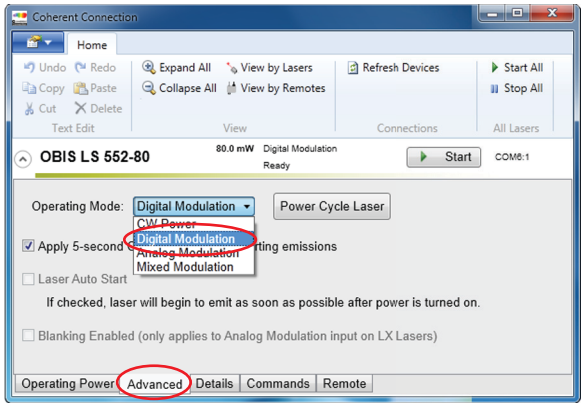


Figure 6-19. Select Digital Modulation

OBIS lasers can operate in Digital Modulation mode to control the laser output power. For high-speed modulation the OBIS LX lasers offer a Digital:Current mode to drive the laser from Off to On in an open-loop control.

OBIS LX offers Digital:Power mode to drive the laser from Off to On in a closed-light loop control. OBIS LS operates in Digital Modulation with a closed-light-loop similar to OBIS LX Digital:Power mode.

Typical waveforms and rise/fall time under Digital modulation (OBIS LX lasers) are shown below. In the example shown in Figure 6-20, the digital signal is a 1.1 to 3.3 Volts, 10 MHz, square wave.

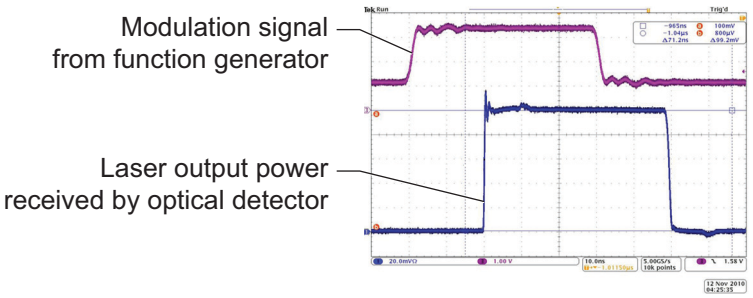


Figure 6-20. Oscilloscope Traces – Digital Modulation

Figure 6-21 shows the typical rise and fall behavior of OBIS Digital modulation. The oscilloscope trace is set to 2 nsec/div.

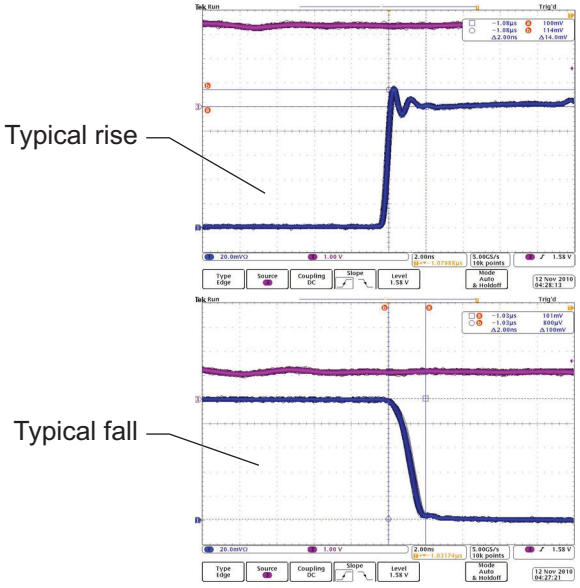


Figure 6-21. Typical Rise and Fall Behavior – Digital Modulation

6.5.3.1 Digital Modulation (LVDS)

The OBIS Laser Family uses an LVDS interface for modulation input voltage. This offers both high-speed modulation capability and good immunity to electric interference.

Figure 6-22 shows a typical LVDS circuit.

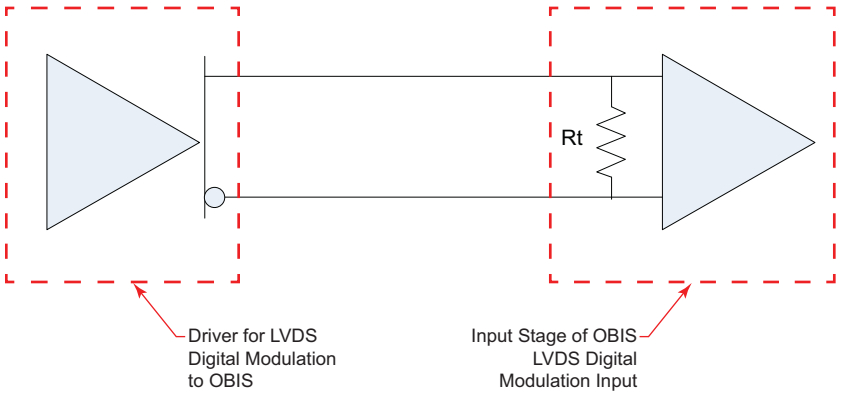


Figure 6-22. LVDS Sample Circuit

The internal resistance of the digital input to the OBIS is 100 ohms. For general information on LVDS technology, refer to:

http://www.ti.com/ww/en/analog/interface/lvds.shtml

For more examples of LVDS and drive electronics, see Part II of the *OBIS LX/LS Operator's Manual.*

6.5.4 Digital:Current (OBIS LX only)

The OBIS LX laser can be digitally modulated at up to 150 MHz in Digital:Current mode. Digital modulation turns the laser from Set Power to Minimum Power. See Figure 6-23 for an example.

For exact Digital Modulation performance specifications for laser wavelength and output power, refer to the OBIS Data Sheet.

Coherent product information and related software is now available in one easily accessible location on the Coherent website. Filter your search by product type, document category, or both. To download manuals and software, go to:

https://www.coherent.com/resources

For more information, see "Field Recalibration Command for OBIS LX" (p. 97).

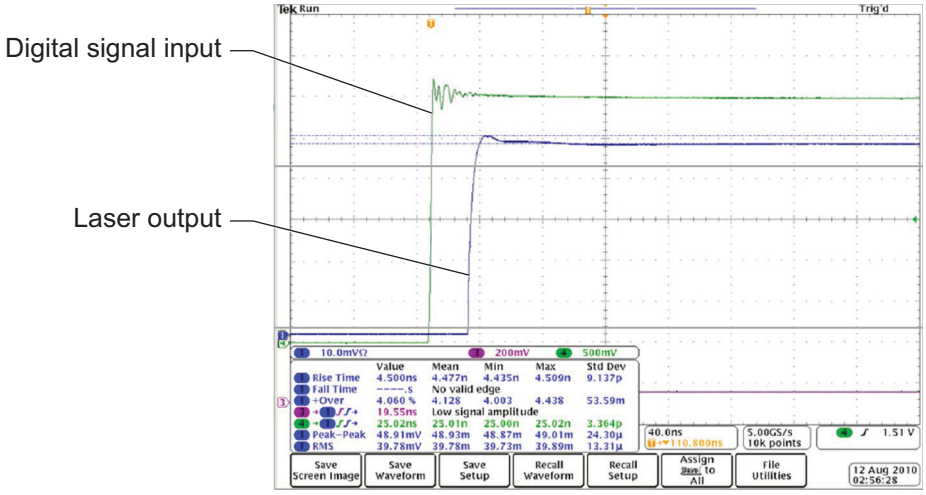


Figure 6-23. OBIS LX Digital Power Input and Laser Output Power

6.5.5 Mixed Modulation

The OBIS Laser System can be modulated by both analog and digital signals at the same time. The OBIS Laser can be operated with Mixed Modulation to vary the laser output power with a analog signal and a digital signal to turn the laser ON and OFF.

The advantage of Mixed Modulation mode is to control the laser power separately from switching the laser from ON to OFF.

Modulation signals are connected to the back of the OBIS Remote through the SMB connectors, shown in Figure 6-24. Note the separate Modulation Input connectors for:

- Analog modulation
- Digital modulation.

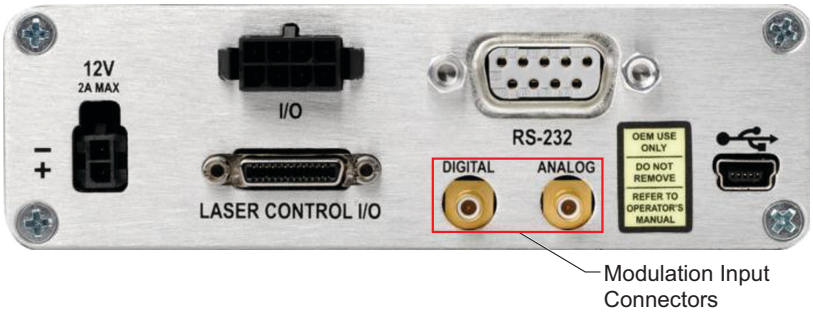


Figure 6-24. Select Modulation Input Connector

To start the mixed modulation mode:

1. Go to the Advanced tab in the Coherent Connection software program.
2. From the *Operating Mode* drop-down menu, select *Mixed Modulation*. If you are using Windows HyperTerminal or other remote terminal program, refer to "OBIS Communications via a Terminal Program" (p. 106).
3. For high-speed modulation, the OBIS LX offers Mixed:Current mode to drive the laser in an open-loop control (see Figure 6-25).

OBIS LX

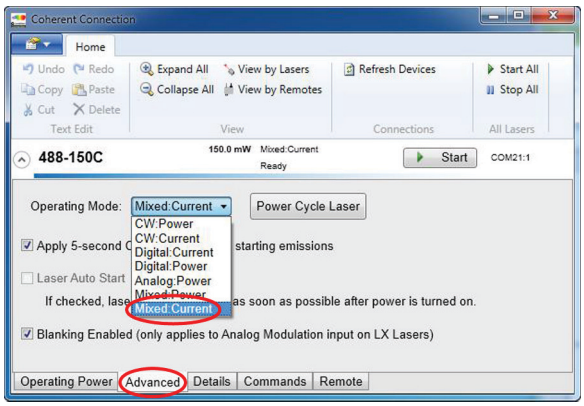


Figure 6-25. Select Mixed Modulation Mode

OBIS LX offers Mixed:Power mode to drive the laser in a closed light-loop control. OBIS LS offers the same closed light-loop as Mixed Modulation, as shown in Figure 6-26.

OBIS LX

OBIS LS

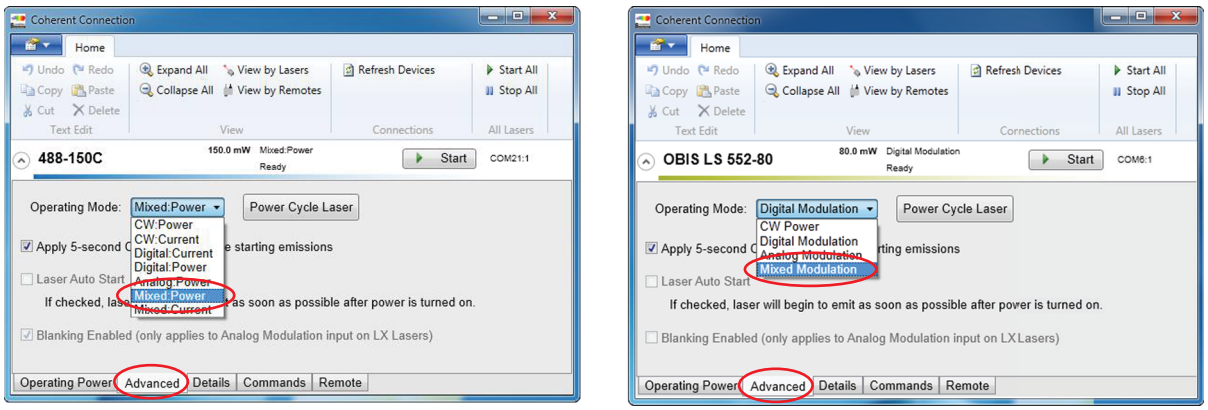


Figure 6-26. Mixed Modulation for OBIS LX and OBIS LS Lasers

An example of mixed modulation is shown below. In this example, the analog signal is a 0 to 5V, 1 kHz triangle wave and the digital signal is a 1.1 to 3.3 Volts, 30 kHz, square wave.

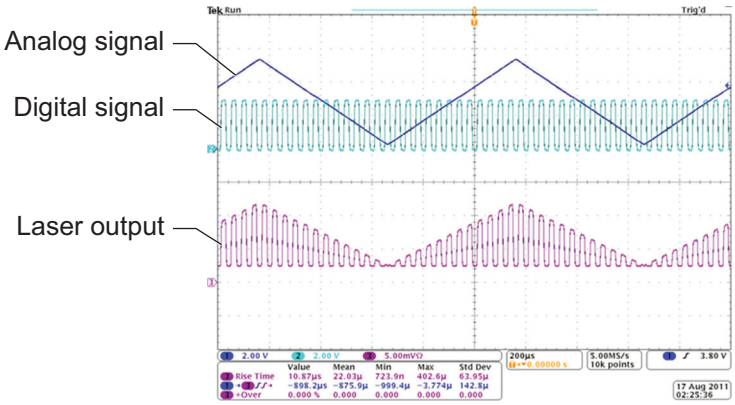


Figure 6-27. Oscilloscope Traces of OBIS Laser Mixed Modulation

6.6 Field Recalibration Command for OBIS LX

OBIS lasers (firmware version 2.x) include Coherent Connection software, which includes a Field Recalibration command.

It is recommended that you use this feature when operating in Digital Modulation mode. The frequency depends on the usage model of the laser. Contact Coherent Product Support for details (see “Appendix - Service & Support” (p. 201)).

You can recalibrate the OBIS LX (Direct Diode) laser using the Coherent Connection software. Use the Field Recalibration feature to have the laser reset the operating current required to drive 100% laser output power.

- This feature must be used **only for** OBIS LX modulation modes with the *current* drive, highlighted in Figure 6-28:

  CW:Current

  Digital:Current

  Mixed:Current

- Field recalibration is **not needed** for CW:Power or the other modulation modes that use closed-light-loop.
- Field calibration requires use of the latest firmware. A popup may display, indicating that a firmware update is required.

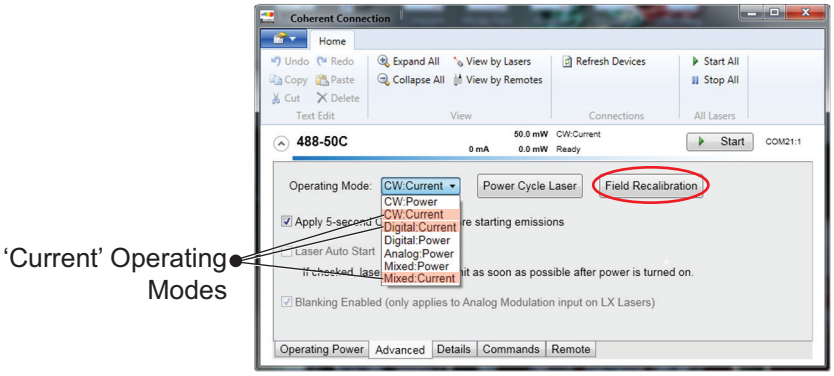


Figure 6-28. Modulation Mode using CURRENT

1. On the Advanced tab, click the **Field Calibration** button shown in Figure 6-29 to start the recalibration process.

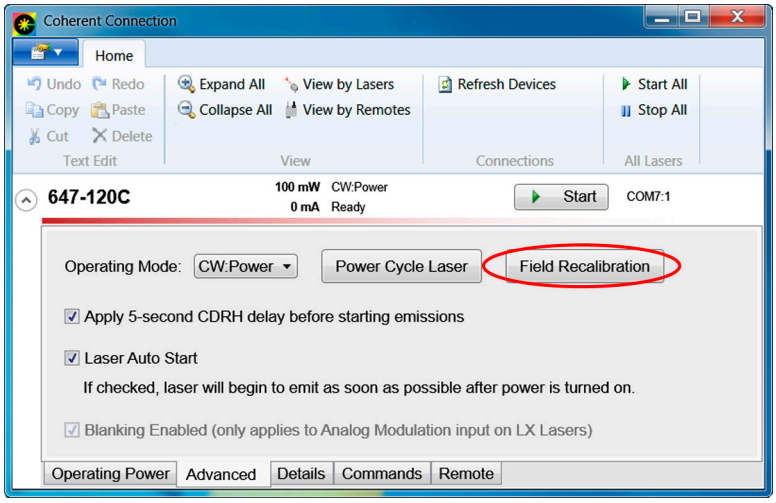


Figure 6-29. Advanced Tab – Field Calibration Command

2. When you click the **Field Power Recalibration** button, the dialog box shown in Figure 6-30 is displayed.

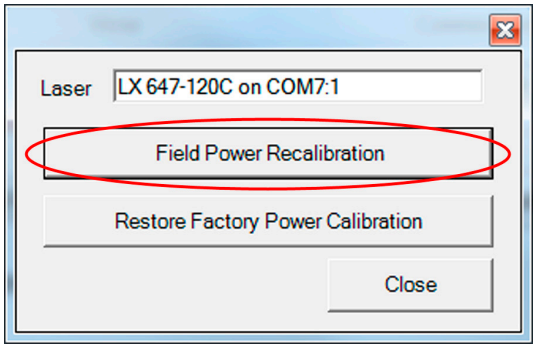


Figure 6-30. Field Calibration Button

WARNING!
TAKE LASER SAFETY PRECAUTIONS BEFORE CONTINUING. The laser immediately goes to full output power during the recalibration process.

3. Click the **Start** button shown in Figure 6-31 to start recalibration.

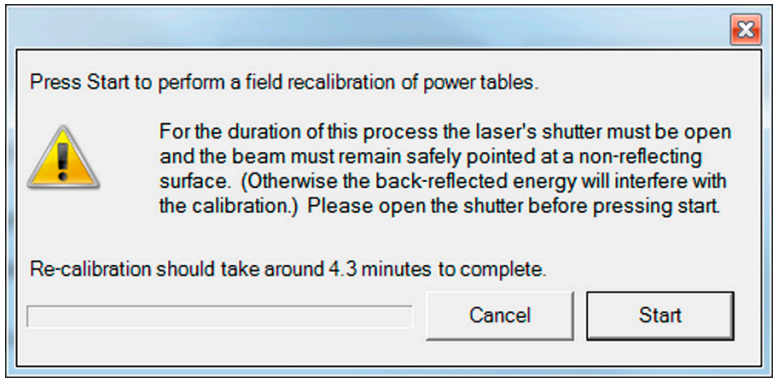


Figure 6-31. Field Calibration—Start Button

During the recalibration process, the OBIS Laser Status indicator flashes, as shown in Figure 6-32.

- The Status LED blinks **RED** while calibrating the laser.
- When the procedure is complete, the Status LED on the OBIS turns BLUE. The procedure takes a few minutes to complete.

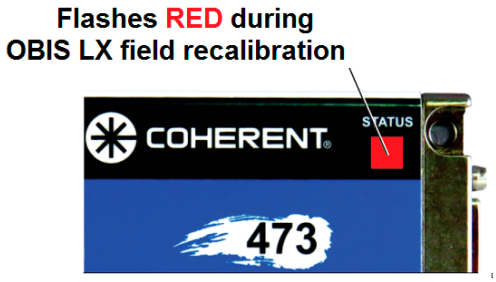


Figure 6-32. OBIS Status LED during Field Calibration

7 ADVANCED PROCEDURES

This section describes the following advanced procedures and settings for the OBIS laser system:

- CDRH delay (this page)
- Auto Start (p. 102)
- Heatsink requirements (p. 103)
- OBIS communications through a terminal program (p. 106)
- Host commands (summary of available commands)

7.1 CDRH Delay

The CDRH-required delay of five (5) seconds or more occurs between a laser-ready condition and emission of laser light. This delay lets the user take appropriate safety precautions before laser emission.

- For an OBIS LX, the CDRH delay is five (5) seconds.
- For an OBIS LS, the CDRH delay is ten (10) seconds.

When the laser is turned OFF (or to STANDBY), the delay is applied to the next time the laser is turned ON.

WARNING!
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The ability to change the state of the CDRH-required delay requires remote communication to the OBIS Laser System through USB or RS-232.

The CDRH setting is stored in persistent memory inside the OBIS Laser.

To enable or disable the CDRH Delay, go to the Advanced tab of the Coherent Connection software, as shown in Figure 7-1.

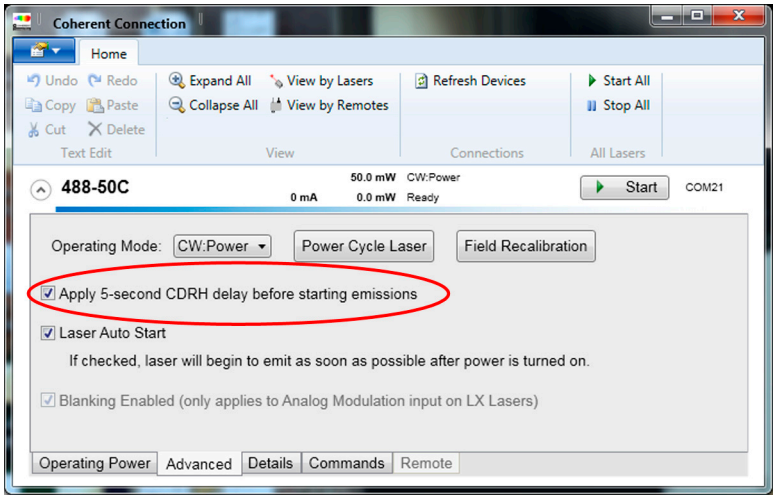


Figure 7-1. Enable/Disable CDRH Delay in Coherent Connection

WARNING!
Removing the 5-second delay defeat the safety controls required by the applicable regulatory agencies. With the use of these commands, the customer takes all responsibility for safety and compliance to CDRH 21 CFR 1040 and IEC60825-1.

If you are not using the Coherent Connection software, you must instead control the OBIS system remotely from a host computer, as follows:

1. To override the CDRH-required delay, use this command:

   ```
   SYSTem:CDRH OFF
   ```

2. Interrogate the current CDRH-required delay status by sending this command:

   ```
   SYSTem:CDRH?
   ```

3. Restore the CDRH-required delay feature by using this command:

   ```
   SYSTem:CDRH ON
   ```

See Part II of the *OBIS LX/LS Operator's Manual* for a list of all commands available to communicate with the laser.

7.1.1 Enable Auto Start With the OBIS Remote

The OBIS Remote has an Auto Start switch that allows laser emission to start without toggling the keyswitch.

WARNING!
With Auto Start enabled on the OBIS Remote, the laser starts at the next power cycle (with keyswitch ON). This occurs even if the laser was previously turned OFF (0) through a USB or RS-232 command.

To set the system to automatically start when 12V power is applied to the OBIS Remote, leave the Power switch ON and the keyswitch ON. The laser starts immediately without user intervention. The laser warm-up period still applies.

WARNING!
Using the OBIS Remote with the back panel Auto Start enabled (1) violates the regulatory safety requirements. The customer takes all responsibility for safety and compliance to CDRH 21 CFR 1040 and IEC60825-1.

The OBIS Remote has an Auto Start switch located under a yellow label on the back panel of the Remote (see Figure 7-2). By default, this switch is set in the OFF position.

Remove the yellow label to access the Auto Start switch.

Table 7-1 lists system start-up details.

7.2 Heatsink Requirement

The OBIS Laser must be sufficiently heatsinked or it will overheat and shut down.

Figure 7-3 shows the heat dissipation of the OBIS Laser for several baseplate temperatures.

Pyrolytic graphite pads can be used to improve thermal contact between the baseplate and the heatsink. Many extruded heatsinks are warped. The mounting surface should be milled flat (within < 0.05 mm over the mounting surface).

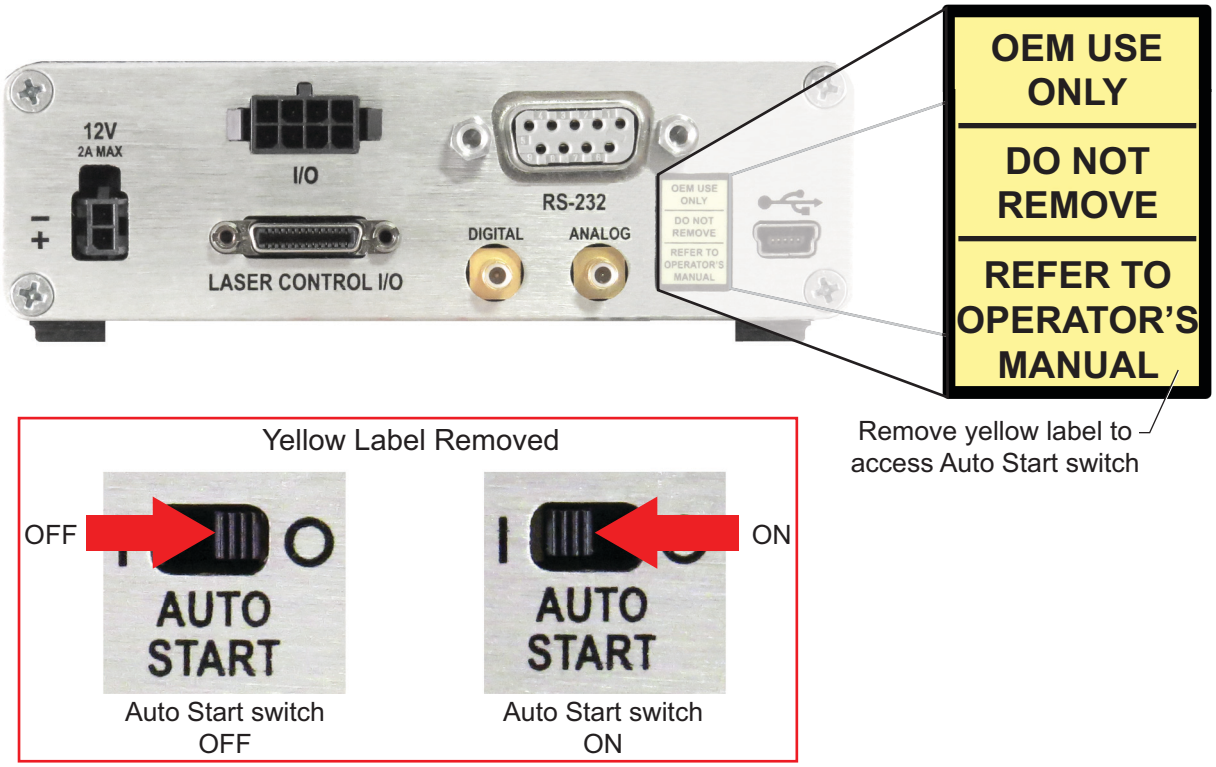


Figure 7-2. OBIS Remote Auto Start Switch Location

Table 7-1. OBIS Laser System Auto Start (at Moment of Power ON)

Auto Start (at moment of Power ON)		
Keyswitch	**Auto Start OFF**	**Auto Start ON**
STANDBY	Laser emission does not occur when the keyswitch is in STANDBY.	Laser emission does not occur when the keyswitch is in STANDBY.
ON	If the keyswitch is ON at Power ON, the keyswitch must be toggled to STANDBY, then back to ON again to start emission.	Light emission starts automatically when warm-up is completed. NOTE: If the OBIS Laser is in any modulation mode without an input signal, the laser output power remains at minimum levels.

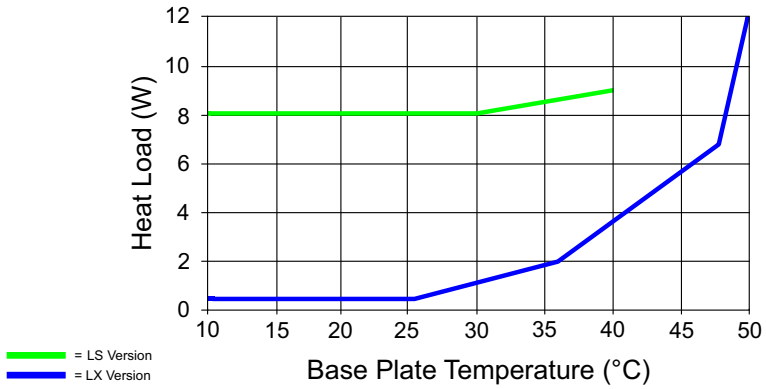


Figure 7-3. Measured Thermal Dissipation Data of the OBIS Laser

NOTICE

DO NOT use thermal grease or thermal compounds. The use of thermal grease or thermal compounds will void the Coherent warranty.

The graph shown in Figure 7-4 helps determine the heatsink thermal impedance requirement.

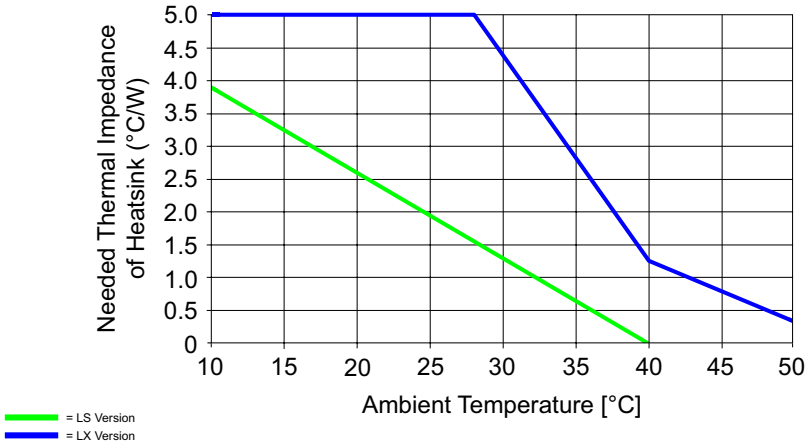


Figure 7-4. Maximum Thermal Impedance of Heatsink to Cool OBIS Laser

7.3 OBIS Communications via a Terminal Program

To use a terminal program to open a communication session and enter commands manually, the COM port for the OBIS Laser laser system must be configured first.

1. Connect the OBIS to a workstation through either a USB connection or an RS-232 connection. The computer identifies the OBIS laser as a COM port on the computer.
2. To determine which COM port is assigned to the OBIS laser, open the Device Manager on the computer. Look for *Coherent OBIS Device* under the *Ports (COM & LPT)* heading, as shown in the example in Figure 7-5.

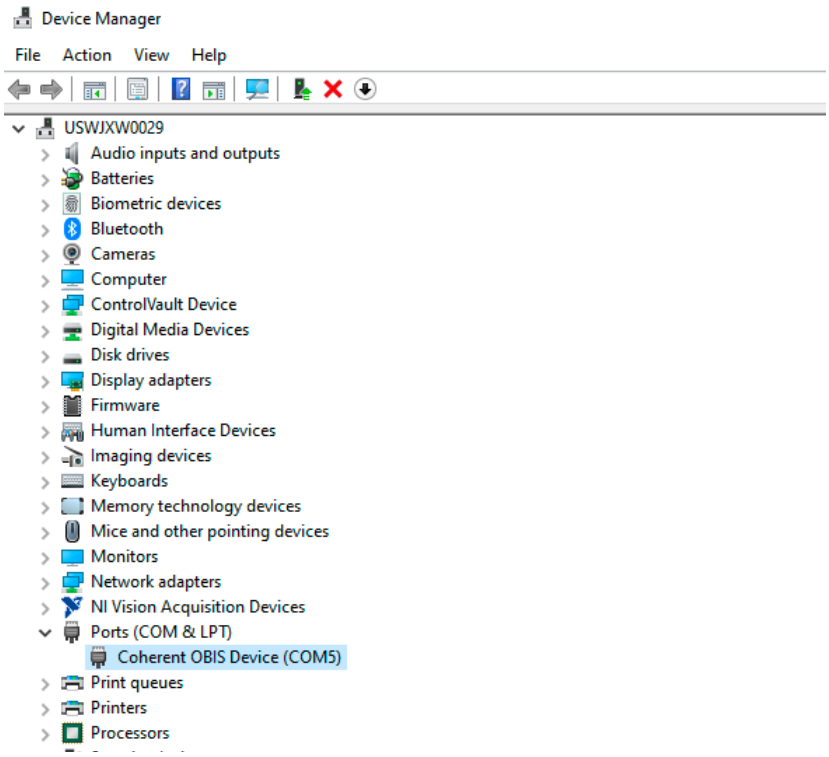


Figure 7-5. Identify the COM Port

3. Open a terminal program and create a file name for the new connection.
4. Select the COM port that is assigned to the OBIS laser (see Step 1) and follow the recommended terminal menu settings shown in the example in Figure 7-6.

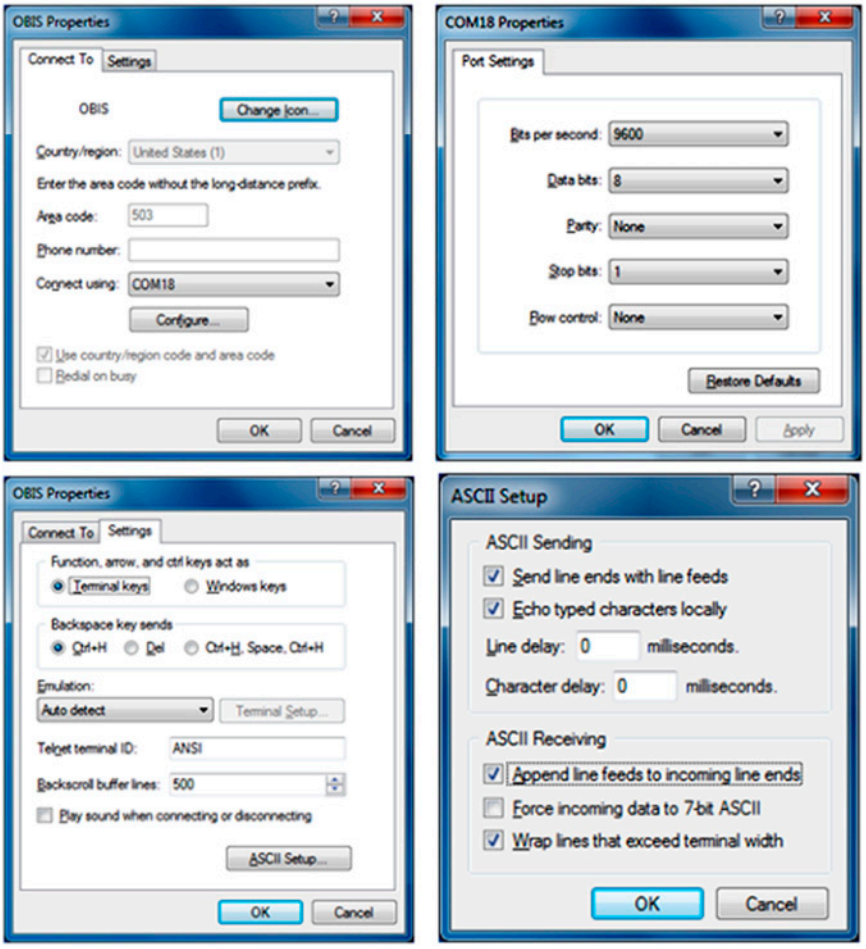


Figure 7-6. Recommended Terminal Menu Settings

5. Go to the terminal main window and activate the connection by pressing the **Call** button.

   The example in Figure 7-7 shows query commands used to check the nominal power level and wavelength of the laser.

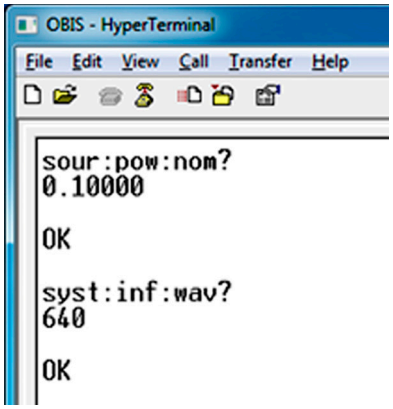


Figure 7-7. Example Query Commands

7.4 Host Commands (Quick Reference)

Table 7-2 lists all host commands and queries available to communicate with the laser. For more detailed information about a specific command or query, see Part II of the *OBIS LX/LS Operator's Manual*.

Table 7-2. Host Command Quick Reference

Command	Description
Mandatory Commands/Queries	
IEEE-488.2	
*IDN?	Gets the laser's identification string
*RST	Causes a device to warm boot if implemented
*TST?	Runs a laser self-test procedure, if implemented
Session Control	
SYSTem:COMMunicate:HANDshaking	Toggles the system handshaking
SYSTem:COMMunicate:HANDshaking?	Queries the system handshaking
SYSTem:COMMunicate:PROMpt	Toggles the system command prompt
SYSTem:COMMunicate:PROMpt?	Queries the system command prompt
SYSTem:AUTostart	Enables or disables the laser Auto Start feature
SYSTem:AUTostart?	Queries the laser Auto Start feature

Table 7-2. Host Command Quick Reference (Continued)

Command	Description
SYSTem:INFormation:AMODulation:TYPe	Sets the analog modulation type
SYSTem:INFormation:AMODulation:TYPe?	Queries the analog modulation type
SYSTem:STATus?	Queries the system status
SYSTem:FAULt?	Queries current system faults
SYSTem:INDicator:LASer	Turn ON/OFF laser status indicator(s)
SYSTem:INDicator:LASer?	Queries laser status indicator(s)
SYSTem:ERRor:COUNt?	Queries the number of error records in the error queue
SYSTem:ERRor:NEXT?	Queries the next error record(s) in the error queue
SYSTem:ERRor:CLEar	Clears all error records in the error queue
OBIS Common Commands/Queries	
System Information	
SYSTem:INFormation:MODel?	Retrieves the model name of the laser
SYSTem:INFormation:MDATe?	Retrieves the manufacture date of the device
SYSTem:INFormation:CDATe?	Retrieves the calibration date of the device
SYSTem:INFormation:SNUMber?	Retrieves the serial number of the laser
SYSTem:INFormation:PNUMber?	Retrieves the manufacturer part number of the laser
SYSTem:INFormation:FVERsion?	Retrieves the current firmware version
SYSTem:INFormation:PVERsion?	Retrieves the current OBIS protocol version
SYSTem:INFormation:WAVelength?	Retrieves the wavelength of the laser
SYSTem:INFormation:POWer?	Retrieves the power rating of the laser
SYSTem:INFormation:TYPe?	Retrieves the device type
SOURce:POWer:NOMinal?	Returns the nominal CW laser output power
SOURce:POWer:LIMit:LOW?	Returns the minimum CW laser output power
SOURce:POWer:LIMit:HIGH?	Returns the maximum CW laser output power
SYSTem:INFormation:USER	Enters and stores user-defined information
SYSTem:INFormation:USER?	Queries user-defined information
SYSTem:INFormation:FCDate	Enters and stores date of last field calibration
SYSTem:INFormation:FCDate?	Queries date of last field calibration

Table 7-2. Host Command Quick Reference (Continued)

Command	Description
System State	
SYSTem:CYCLes?	Returns the number of ON/OFF power cycles
SYSTem:HOURs?	Returns the hours the laser has been powered on
SYSTem:DIODe:HOURs?	Returns the hours the laser diode has operated
SOURce:POWer:LEVel?	Returns the present output power of the laser
SOURce:POWer:CURRent?	Returns the present output current of the laser
SOURce:TEMPerature:BASeplate?	Returns the present laser base plate temperature
SYSTem:LOCK?	Returns the status of the system interlock
Operational	
SOURce:AM:INTernal	Sets the laser operating mode to internal CW
SOURce:AM:EXTernal	Sets the laser operating mode to external modulation
SOURce:AM:SOURce?	Queries the current operating mode of the laser
SOURce:POWer:LEVel:IMMediate:AMPLitude	Sets present laser power level
SOURce:AM:STATe	Turns the laser ON or OFF
SOURce:AM:STATe?	Queries the current laser emission status
SYSTem:CDRH	Enables or disables the CDRH laser emission delay
SYSTem:CDRH?	Queries the status of the CDRH laser emission delay
OBIS Optional Commands/Queries	
SOURce:TEMPerature:APRobe	Enables/disables temperature control of the laser diode
SOURce:TEMPerature:APRobe?	Queries temperature control of the laser diode
OBIS LX-Specific Commands/Queries	
SOURce:POWer:CALibration	Starts a self-laser power calibration
SOURce:POWer:UNCalibration	Undoes the filed calibration
SOURce:AModulation:BLANKing	Enables/disables Blanking in Analog Modulation mode
SOUR:AM:BLAN?	Queries present state of Analog Modulation Blanking
SOURce:TEMPerature:PROTection:INTernal:HIGH?	Queries the high internal temperature limit settings
SOURce:TEMPerature:PROTection:INTernal:LOW?	Queries the low internal temperature limit settings
SOURce:TEMPerature:DIODe?	Queries the present laser diode temperature

Table 7-2. Host Command Quick Reference (Continued)

Command	Description
SOURce:TEMPerature:DSETpoint?	Queries the diode set point temperature
SOURce:TEMPerature:INTernal?	Queries the present internal laser temperature

Figure 7-3 shows an example of the command/query for the indicator status light on the top cover of the OBIS:

Table 7-3. Example Command/Query

Command	Description
SYST:IND:LAS ON	Turns the OBIS top cover indicator ON. Do not use SYST:IND:LAS=1. Do not use SYST:IND:LAS 1.
SYST:IND:LAS OFF	Turns the OBIS top cover indicator OFF. Do not use SYST:IND:LAS=0. Do not use SYST:IND:LAS 0.
SYST:IND:LAS?	Returns the value of the indicator as ON or OFF. It will not return a 1 or a 0. The reply will be ON or OFF.

7.4.1 How to Communicate to a Multiple-Laser Remote

SCPI channel selection is performed by appending a numeric suffix to the base word in any command string. When the numeric suffix is left off or has a value of zero, the command refers to the first connected device.

For example, **`*idn?*`** and **`*idn0?`** query strings both refer to the first connected device. If a host computer is connected to a controller and this query is issued, it is responded to by the controller. If the host is connected directly to a laser, without going through a controller, the first connected device is the laser and it should respond.

Consider the scenario where the host computer is connected to a mini-controller which, in turn, is connected to a laser.

If the host issues the **`*idn?*`** query, the OBIS Remote should respond. If, however, the host appends a numeric suffix to the base word of the query, then the suffix specifies the device which should respond. In this scenario **`*idn?*`** and **`*idn0?`** would be responded to by the OBIS Remote, **`*idn1?*`** would be responded to by the laser, and **`*idn2?*`** would receive no response since device number 2 does not exist.

If the host is connected to a master controller with four connected lasers, then a missing or zero suffix would apply to the master controller and suffixes 1…4 would refer to lasers 1…4.

The numeric suffix mechanism may be applied to the base word of any command or query.

8 INTEGRATION

For system integration, the OBIS Laser can be operated without the OBIS Remote by connecting the USB cable and the power cable to the back of the laser.

Either Coherent Connection software or a terminal program (for example, Windows terminal) can be used for remote control of the laser.

In this section:

WARNING!
The OBIS Laser without the OBIS Remote is NOT CDRH-compliant. The user assumes all responsibility for safety and proper compliance to CDRH 21 CFR 1040 and IEC60825-1.

8.1 Install the OBIS Laser

Installation of the OBIS Laser in this manner without a remote, consists of the following steps:

1. Remove the yellow label that covers the POWER connection. *DO NOT remove the gray label next to it (unless the fan output power is used)*.
2. Connect the power cable and the optional USB cable (if desired).

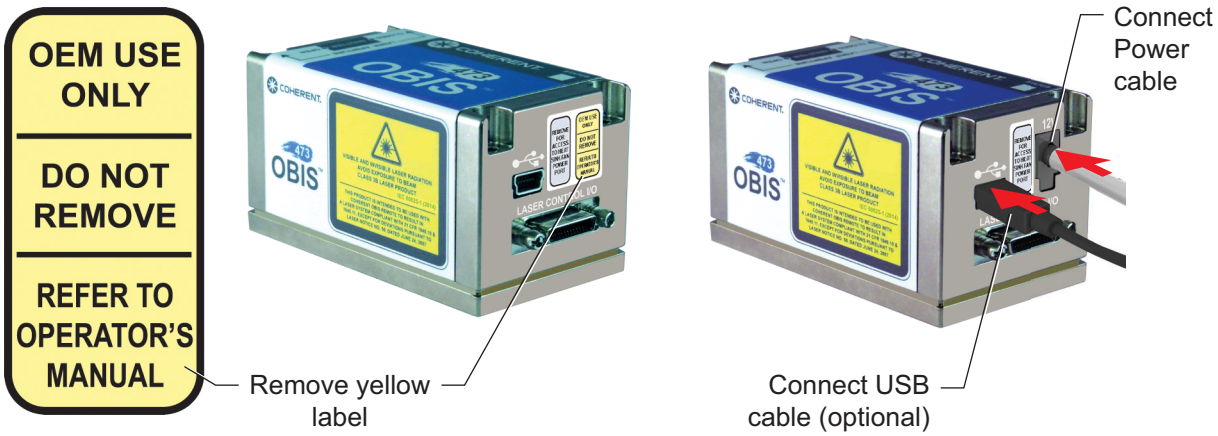


Figure 8-1. Connecting Power and the Optional USB Cable

8.2 Mounting Hardware Recommendation

M3 x 35 mm screws with small pattern washers (4 each, supplied) or 4-40 x 1 3/8 in. screws with small pattern flat washer. Refer to Figure 3-9 (p. 47) for the torque pattern.

8.3 Power Supply Requirements

OBIS lasers require 12 Volts DC with a power supply capable of 2A of current. For specific product power requirements, refer to the OBIS Data Sheet.

Coherent product information and related software is available in one easily accessible location on the Coherent website. To download the current software, as well as a a copy of the complete *OBIS LX/LS Operator's Manual* (P/N 1184163), go to:

https://www.coherent.com/resources

8.4 Enable or Disable Auto Start

To enable or disable Laser Auto Start, go to the Advanced sub-tab of the Coherent Connection software. Refer to Figure 8-2 (p. 115).

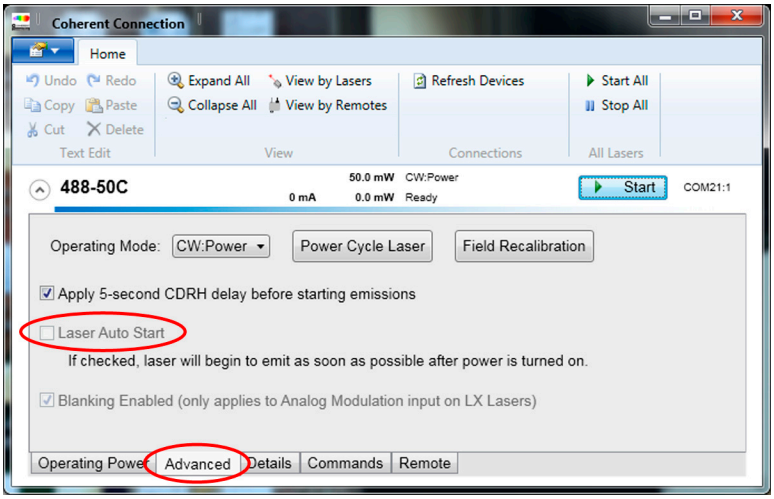


Figure 8-2. OBIS LX (Direct Diode) Auto Start

8.5 OBIS Laser SDR Connector Pin-Outs

Table 8-1 provides a detailed list of all signals for the OBIS Laser SDR connector.

Table 8-1. OBIS Laser SDR Connector Pin-Out Specifications

Signal Name	Pin No.	Wire Color Code	Direc-tion	Function	Characteristics
RS-485 Inhibit	1	Black	Digital Input	RS485 communica-tion enable (flow control)	Default: High with 10K pull-up to 3.3V on the laser. Must be set to less than 0.5V to enable RS-485 commu-nication. ***Default: Low (ground) for OBIS LX with firmware prior to 2.2.x***. Refer to Part II of the *Oper-ator's Manual*.
Power Return	2	Brown	GND	Return for all power and digital lines	Common ground
Power Return	3	Red	GND	Return for all power and digital lines	Common ground
Laser Diode Power	4	Orange	Power Input	+12 VDC for diode supply (no voltage => no diode current)	10 to 14V, up to 1.0A (16W maximum total including fan)

Table 8-1. OBIS Laser SDR Connector Pin-Out Specifications (Continued)

Signal Name	Pin No.	Wire Color Code	Direc-tion	Function	Characteristics
Laser Diode Power	5	Yellow	Power Input	+12 VDC for diode supply (no voltage => no diode power)	Parallel pin for extra current capacity
System Power	6	Green	Power Input	+12V for general supply	10 to 14V, up to 1.0A (16W maximum total including fan)
No Connect	7	Blue	Spare		
Laser Ready	8	Violet	Analog Out	Status signal: goes high when laser is stable at set power	> 2.5V when laser output imped-ance ≤ 200 Ohm and output power is within ± 2% set power
Baseplate Temperature	9	Gray	Analog Out	Status signal: 3-state-signal for base plate temperature	< 0.5V: baseplate temperature below (upper limit - 10°C) 1.2 to 2V: baseplate between upper limit and (upper limit - 10°C) > 2.7V: baseplate above upper limit Impedance ≤ 200 Ohm
RS-485 Communication Positive	10	Red	Bidirec-tional	RS-485 communica-tion line	See RS-485 specifications for detailed description. Half-duplex 1 MBit 8N1 @ 0 to 3.3V
Analog Modula-tion Negative	11	Orange	Analog Input	Negative analog modulation line	Negative line for analog power modulation (1Vpp differential, 0 to 4V on any line) 100 ohm termination against in 24
Digital Modula-tion Negative	12	Brown	Digital Input	Negative digital modulation line	Negative LVDS line for Laser ON/ OFF 100 ohm termination against pin 25 If digital or mixed modulation is enabled, connect to a voltage source for defined emission control.
SDR In-Use Return	13	White	Bidirec-tional	Switching signal for SDR usage, USB inhibit	Connected to GND on the laser, signal must be looped back to pin 14 of the SDR connector on the host to enable SDR interface
SDR In-Use	14	Pink	Bidirec-tional	Switching signal for SDR usage, USB inhibit	Pulled-up with 10K to 3.3V on the laser, signal must be looped back to pin 13 of the SDR connector on the host to enable SDR interface
Power Return	15	Light Green	GND	Return for all power and digital lines	Common ground

Table 8-1. OBIS Laser SDR Connector Pin-Out Specifications (Continued)

Signal Name	Pin No.	Wire Color Code	Direc-tion	Function	Characteristics
Power Return	16	Black/ White	GND	Return for all power and digital lines	Common ground
Laser Diode Power	17	Brown/ White	Power Input	+12V DC for diode supply (no voltage => no diode power)	Parallel pin for extra current capacity
System Power	18	Red/ White	Power Input	+12V for general supply	Parallel pin for extra current capacity
System Power	19	Orange/ White	Power Input	+12V for general supply	Parallel pin for extra current capacity
Diode Current	20	Green/ White	Analog Out	Status signal: actual diode current	2V = laser at maximum allowed diode current Output impedance ≤ 200 Ohm
Laser Fault	21	Blue/ White	Analog Out	Status signal: goes high when laser is in error state	< 0.5V: laser OK > 2.5V: laser error Output impedance ≤ 200 Ohm
Power Monitor	22	Violet/ White	Analog Out	Status signal: actual laser output power	2V = laser at 100% of nominal power Output impedance ≤ 200 Ohm
RS-485 Communication Negative	23	Green	Bidirec-tional	RS-485 communica-tion line	See RS-485 specifications for detailed description.
Analog Modula-tion Positive	24	Blue	Analog Input	Positive analog modulation line	Positive line for analog power modu-lation (1Vpp differential, 0 to 4V on any line) 100 ohm termination against pin 11
Digital Modula-tion Positive	25	Yellow	Digital Input	Positive digital modu-lation line	Positive LVDS line for laser ON/OFF 100 ohm termination against pin 12 If digital or mixed modulation is enabled, connect to a voltage source for defined emission control.
Signal Return	26	Red/ Black	GND	Return for power monitor	Common ground
Over-All Electrostatic Shield	Shel l	Drain	GND	Shield drain	Common ground

9 TROUBLESHOOTING

If you experience any difficulties with the OBIS Laser System, first check the procedures in this section.

If you cannot solve the problem or need more product or technical assistance, contact Coherent Technical Support as follows:

- By email: customer.support@coherent.com
- Visit our website: www.Coherent.com
- By phone: +**1 (734) 456-3100**

Also see “Appendix - Service & Support” (p. 201) for more information.

See Part 2 of the Operator’s Manual for additional information about the following:

- OBIS 6-Laser Remote
- OBIS Scientific Remote
- OBIS Laser Box
- OBIS Galaxy Beam Combiner

CAUTION!
Remember to take ESD precautions when handling and installing a laser. Refer to “Electrical Safety” (p. 132) for more information about ESD precautions.

9.1 Troubleshooting Procedures

Table 9-1 lists possible issues, with a reference to the related troubleshooting checklist.

The following checklists provide recommended actions.

Table 9-1. OBIS System Troubleshooting Procedures

Problem	Reference
No output power from the laser	Checklist 1 (p. 120)
Laser output power is lower than expected	Checklist 2 (p. 121)
Base plate temperature error	Checklist 3 (p. 122)
The OBIS Remote is powered up and switched to the ON position, but the OBIS Laser is not emitting and remains in STANDBY mode	Checklist 4 (p. 122)
The LED on top of the OBIS Laser is not functioning	Checklist 5 (p. 123)

9.1.1 Checklist 1: Symptom: No output power from the laser.

If there is no output power from the laser, do the following steps in the order shown:

[ ] Cycle laser power, OFF/ON.

[ ] Many customers are hitting "AUTOSTART=OFF" when using the laser directly with a power supply. The solution is to connect to a PC and use Coherent Connection to set "AUTOSTART=ON" so the laser will power-on when the 12 Volt power to the back panel is applied.

[ ] Check to make sure the laser shutter is open and that nothing is blocking the output aperture on the laser. ***Follow correct safety procedures when inspecting the output aperture and the shutter on the laser***.

[ ] Check for fault Status LEDs on the OBIS Laser and on the OBIS Remote—refer to "Status LED Indicator" (p. 13) and "OBIS Remote Status Indicators" (p. 27). If using a computer interface, check fault status either in the Coherent Connection software or by using the remote command **`SYST:FAUL?`** For more information, refer to Part II of this Operator's Manual.

[ ] Check the "laser on" status through the LED indicators on the OBIS Remote and on the OBIS Laser. The "laser on" status can also be checked through either the Coherent Connection software or through the remote command **`SOUR:AM:STAT?`**

[ ] Check the operating mode of the laser by using either the Coherent Connection software or the remote command **SOUR:AM:SOUR?** For normal CW mode, the laser should be in “CW Power” mode in the OBIS software or should reply with “CWP” when using the remote command.

[ ] Check the set power level of the laser using either the Coherent Connection software or the remote command **SOUR:POW:LEV:IMM:AMPL?** This should reply with the power level that the laser is currently set to output.

[ ] Contact Coherent Technical Support; see “Appendix - Service & Support” (p. 201).

9.1.2 Checklist 2: Symptom: Laser output power is lower than expected.

If the laser output power is lower than expected, do the following steps in the order shown:

[ ] Cycle laser power, OFF/ON.

[ ] Check to make sure the laser shutter is fully open and that nothing is blocking the output aperture on the laser. ***Follow correct safety procedures when inspecting the output aperture and the shutter on the laser***.

[ ] Check for fault Status LEDs on the OBIS Laser and on the OBIS Remote—refer to “Status LED Indicator” (p. 13) and “OBIS Remote Status Indicators” (p. 27). If using a computer interface, check fault status either in the Coherent Connection software or by using the remote command **SYST:FAUL?** For more information, refer to Part II of this Operator’s Manual.

[ ] Check the operating mode of the laser using either the Coherent Connection software or the remote command **SOUR:AM:SOUR?** For normal CW mode, the laser should be in “CW Power” mode in the OBIS software or should reply with “CWP” using the remote command.

[ ] Check the set power level of the laser using either the Coherent Connection software or the remote command **SOUR:POW:LEV:IMM:AMPL?** This should reply with the power level that the laser is currently set to output.

[ ] Confirm the output power level of the OBIS Laser using an external power meter that is calibrated and is appropriate for the output power level from the laser.

[ ] If using the laser in a CURRENT mode (not CW Power) then a period recalibration of the power-to-diode-current may be necessary—refer to “Field Recalibration Command for OBIS LX” (p. 97).

[ ] Contact Coherent Technical Support; see "Appendix - Service & Support" (p. 201).

9.1.3 Checklist 3: Symptom: Base plate temperature error.

If there is a base plate temperature error, do the following steps in the order shown:

[ ] Cycle laser power, OFF/ON.

[ ] Check the reported base plate temperature using either the Coherent Connection software or the remote command `SOUR:TEMP:BAS?` The maximum baseplate temperature should be 40°C for an OBIS LS or 50°C for an OBIS LX.

[ ] Verify the laser is mounted correctly to a properly-sized heatsink—refer to "Heatsink Requirement" (p. 103). The laser and heatsink should have metal-to-metal contact. Verify that the base plate is mounted to a heatsink that has a smooth surface. The mounting surface should be milled flat (within < 0.05 mm over the mounting surface).

NOTICE

DO NOT use thermal grease or thermal compounds. The use of thermal grease or thermal compounds will void the warranty.

[ ] Verify that the ambient temperature is not more than 40°C for an OBIS LS or 50°C for an OBIS LX.

9.1.4 Checklist 4: Symptom: The OBIS Remote is powered up and switched to the ON position, but the OBIS Laser is not emitting and remains in STANDBY Mode.

[ ] If the keyswitch on the OBIS Remote is in the ON position when the OBIS Remote is turned on, the keyswitch must be cycled for the laser to come out of STANDBY mode. Turn the keyswitch to the STANDBY position and then back to the ON position. The LED on the OBIS Laser should turn white and the laser will begin emission after a 5-second delay.

[ ] Check to make sure the laser is not turned off through its software interface. To do that, open the Coherent Connection software and press the **Start** or **All Start** button.

9.1.5 Checklist 5: Symptom: The LED on top of the OBIS laser is not functioning.

[ ] Make sure the LED is not disabled through the Coherent Connection software. With the laser powered up and connected to a computer, the LED setting can be found under the Preferences tab in the Coherent Connection software. To confirm LED status, enter the **`SYSTem:INDicator:LASer?`** query.
A response of ON means that the LED is NOT disabled.

I APPENDIX - LASER SAFETY

This section describes critical safety information about:

- Hazards (this page)
- Optical Safety (p. 126)
- Electrical Safety (p. 132)
- Compliance with Government Requirements (p. 138)
- Location of Safety Labels (p. 144)

Review this section thoroughly prior to operating any Coherent laser. carefully follow any safety instructions presented throughout this manual.

WARNING!
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

This user information is in compliance with the following standards for Light-Emitting Products IEC 60825-1 / EN 60825-1 *"Safety of laser products - Part 1: Equipment classification and requirements"* 21 CFR Title 21 Chapter 1, Subchapter J, Part 1040 *"Performance standards for light-emitting products"*.

WARNING!
LASER RADIATION - AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 3B LASER PRODUCT!

I.1 Hazards

Hazards associated with lasers generally fall into the following categories:

- Biological hazards from exposure to laser radiation that may damage the eyes or skin

- Electrical hazards generated in the laser power supply or associated circuits
- Chemical hazards resulting from contact of the laser beam with volatile or flammable substances, or released as a result of laser material processing

The above list is not intended to be exhaustive. Anyone operating the laser must consider the interaction of the laser system with its specific working environment to identify potential hazards.

I.2 Optical Safety

Laser light, because of its optical qualities, poses safety hazards not associated with light from conventional light sources. The safe use of lasers requires all operators, and everyone near the laser system, to be aware of the dangers involved. Users must be familiar with the instrument and the properties of coherent, intense beams of light.

The safety precautions listed below are to be read and observed by anyone working with or near the laser. At all times, ensure that all personnel who operate, maintain or service the laser are protected from accidental or unnecessary exposure to laser radiation exceeding the accessible emission limits defined in the laser safety standards.

WARNING!
Direct eye contact with the output beam from the laser may cause serious eye injury and possible blindness.

The greatest concern when using a laser is eye safety. In addition to the main beam, there are often many smaller beams present at various angles near the laser system. These beams are formed by specular reflections of the main beam at polished surfaces such as lenses or beam splitters. While weaker than the main beam, such beams may still be sufficiently intense to cause eye damage.

Laser beams are powerful enough to burn skin, clothing, or combustible materials, even at some distance. They can ignite volatile substances such as alcohol, gasoline, ether, and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers, and photodiodes. Follow the control measures described in the sections that follow.

I.2.0.1 Recommended Precautions and Guidelines

Following are recommended precautions and guidelines:

1. Observe all safety precautions in the pre-installation and operator's manuals.
2. Always wear appropriate eyewear for protection against the specific wavelengths and laser energy being generated. See "Laser Safety Eyewear" (p. 128) for additional information.
3. Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
4. Stay aware of the laser beam path, particularly when external optics are used to steer the beam. See "Appendix - Laser Back Reflection" (p. 147) for more detailed information about Laser Back Reflection.
5. Provide enclosures for beam paths whenever possible.
6. Use appropriate energy-absorbing targets for beam blocking.
7. Block the beam before applying tools such as Allen wrenches or ball drivers to external optics.
8. Limit access to the laser to trained and qualified users who are familiar with laser safety practices. When not in use, lasers should be shut down completely and made off-limits to unauthorized personnel.
9. Terminate the laser beam with a light-absorbing material. Laser light can remain collimated over long distances and therefore presents a potential hazard if not confined. It is good practice to operate the laser in an enclosed room.
10. Post laser warning signs in the area of the laser beam to alert those present.
11. Exercise extreme caution when using solvents in the area of the laser.
12. Never look directly into the laser light source or at scattered laser light from any reflective surface, even when wearing laser safety eyewear. Never sight down the beam.
13. Set up the laser so that the beam height is either well below or well above eye level.
14. Avoid direct exposure to the laser light. Laser beams can easily cause flesh burns or ignite clothing.
15. Advise all those working with or near the laser of these precautions.

I.2.1 Laser Safety Eyewear

Always wear appropriate laser safety eyewear for protection against the specific wavelengths and laser energy being generated. The appropriate eye protection can be calculated as defined in the "EN 207 Personal eye protection equipment—Filters and eye-protectors against laser radiation (laser eye-protectors)", in other national or international standards (such as ANSI, ACGIH, or OSHA) or as defined in national safety requirements.

CAUTION!
Laser safety eyewear protects the user from accidental exposure to laser radiation by blocking light at the laser wavelengths. However, laser safety eyewear may also prevent the operator from seeing the beam or the beam spot. Exercise extreme caution even while wearing safety glasses.

I.2.2 Viewing Distance

The OBIS Laser produces optical power levels that are dangerous to the eyes and skin if exposed directly or indirectly. This product must be operated only when using proper eye and skin protection at all times. Never view directly emitted or scattered radiation with unprotected eyes.

Table I-1 summarizes the Maximum Permissible Exposure (MPE) levels as specified in IEC 60825-1 at a 100 second time base for the nominal wavelength (respectively, the nominal fundamental wavelength).

This applies to OBIS LX (Diode) and OBIS LX FP (Diode, Pigtailed) Laser***s.***

Table I-1. Maximum Emission of OBIS LX Lasers

Wave-length Class	Power Class	Wavelength	Max. Power
375 nm	≤ 50 mW	0.36 – 0.39 µm	≤ 100 mW
405 nm	≤ 400 mW	0.39 – 0.42 µm	≤ 490 mW
422 nm	≤ 100 mW	0.40 – 0.44 µm	≤ 200 mW
445 nm	≤ 400 mW	0.43 – 0.46 µm	≤ 490 mW

Table I-1. Maximum Emission of OBIS LX Lasers

Wave-length Class	Power Class	Wavelength	Max. Power
458 nm	≤ 400 mW	0.44 – 0.47 µm	≤ 490 mW
473 nm	≤ 200 mW	0.46 – 0.49 µm	≤ 300 mW
488 nm	≤ 200 mW	0.47 – 0.50 µm	≤ 300 mW
505 nm	≤ 100 mW	0.49 – 0.52 µm	≤ 200 mW
514 nm	≤ 50 mW	0.50 – 0.53 µm	≤ 100 mW
522 nm	≤ 50 mW	0.51 – 0.54 µm	≤ 100 mW
637 nm	≤ 200 mW	0.63 – 0.65 µm	≤ 300 mW
640 nm	≤ 200 mW	0.63 – 0.65 µm	≤ 300 mW
647 nm	≤ 100 mW	0.63 – 0.66 µm	≤ 200 mW
660 nm	≤ 100 mW	0.64 – 0.68 µm	≤ 200 mW
685 nm	≤ 100 mW	0.67 – 0.70 µm	≤ 200 mW
730 nm	≤ 100 mW	0.71 – 0.75 µm	≤ 200 mW
785 nm	≤ 100 mW	0.77 – 0.80 µm	≤ 200 mW
808 nm	≤ 150 mW	0.79 – 0.82 µm	≤ 250 mW
980 nm	≤ 150 mW	0.97 – 0.99 µm	≤ 250 mW

With the maximum power according to Table I-1 with an M^2 of 1 and a nominal beam diameter of 0.7 mm, the direct beam of the listed models can result in Nominal Ocular Hazard Distances (NOHDs). These distances can be up to 600 meters for the unaided eye (7 mm pupil diameter).

If the view is aided by magnifying tools with an entrance aperture of 50 mm diameter, the resulting Extended Ocular Hazard Distance (EOHD) reaches up to 4 km. The excess of the skin's MPE can occur within distances of up to 30 m.

Any modification of the beam's properties with external optics has direct influence on these distances and can result in even longer ranges. For these reasons, it is strongly recommended that you confine the beam and operate it only in enclosed rooms, using appropriate laser safety precautions.

I.2.3 Maximum Accessible Radiation Level

The OBIS System may emit VISIBLE or INVISIBLE LASER RADIATION over wavelengths of 0.45 to 1.2 mm from the aperture in the front of the laser, with a maximum of 480 mW continuous wave power. The potentially accessible emissions depend on the specific model.

Table I-2 lists the applicable emission parameters for OBIS LS (OPSL) and OBIS LS FP (OPSL, Pigtailed) Lasers.

Table I-2. Maximum Emission of OBIS LS Lasers

Wavelength	Power Class	Range	Max. Power
488 nm	15, 20 mW	0.45 - 0.50 µm	< 350 mW
		0.90 - 1.00 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW… 200 mW	0.45 - 0.50 µm	< 480 mW
		0.90 - 1.00 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
505 nm	15, 30 mW	0.49 - 0.52 µm	< 350 mW
		0.96 - 1.06 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW… 150 mW	0.49 - 0.52 µm	< 480 mW
		0.96 - 1.06 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
514 nm	15, 20 mW	0.50 - 0.53 µm	< 350 mW
		1.00 - 1.10 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW … 150 mW	0.50 - 0.53 µm	< 480 mW
		1.00 - 1.10 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW

Table I-2. Maximum Emission of OBIS LS Lasers (Continued)

Wavelength	Power Class	Range	Max. Power
532 nm	15, 20 mW	0.52 - 0.55 µm	< 350 mW
		1.00 - 1.10 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW … 200 mW	0.52 - 0.55 µm	< 480 mW
		1.00 - 1.10 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
552 nm	15, 20 mW	0.53 - 0.57 µm	< 350 mW
		1.00 - 1.20 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW… 200 mW	0.53 - 0.57 µm	< 480 mW
		1.10 - 1.20 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
561 nm	15, 20 mW	0.53 - 0.57 µm	< 350 mW
		1.10 - 1.20 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW… 200 mW	0.53 - 0.57 µm	< 480 mW
		1.10 - 1.20 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
594 nm	15, 20 mW	0.58 - 0.61 µm	< 350 mW
		1.15 - 1.21 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW
	40 mW … 100 mW	0.58 - 0.61 µm	< 480 mW
		1.15 - 1.21 µm	< 50 mW
		0.79 - 0.82 µm	< 20 mW

I.3 Electrical Safety

The OBIS Lasers do not have dangerous voltages.

DO NOT disassemble the enclosure. There are no user serviceable components in the controller or laser head. All units are designed to be operated as assembled. ***The Warranty will be voided if the laser head, the controller, or the cable is disassembled.***

CAUTION!

Electrostatic charges as high as 4000 volts easily collect on the human body and equipment and can discharge without detection.

Although the electronics features have input protection, permanent damage can occur on devices subjected to high-energy electrostatic discharges. You must take correct ESD precautions to prevent damage or performance degradation.

The most common ESD damage occurs when handling a device during installation or use. Take the necessary measures to protect the system from ESD.

Dry air and carpet also create a higher potential for ESD. Remember to take precautions or shielding not only for operations, but for demonstrations or trade show exhibitions.

I.3.1 Precautions and Guidelines

The following precautions must be observed by everyone when working with potentially hazardous electrical circuitry:

DANGER!

When working with electrical power systems, the rules for electrical safety must be strictly followed. Failure to do so could result in the exposure to lethal levels of electricity.

1. Disconnect power before working on any electrical equipment when it is not necessary for the equipment to be operating.
2. Do not short or ground the power supply output. Protection against possible hazards requires proper connection of the ground terminal on the power cable, and an adequate external ground. Check these connections at the time of installation, and periodically thereafter.

3. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who is competent to administer first aid.
4. When possible, keep one hand away from the equipment to reduce the danger of current flowing through the body if a live circuit is touched accidentally.
5. Always use approved, insulated tools.

I.3.2 Safety Features

The OBIS family of products has been certified by an outside testing lab to be in compliance with the environmental and safety directives listed in this section.

NOTICE

Use of the system in a manner other than that described herein may impair the protection provided by the system. *Do not use the OBIS Laser or Controller if they are damaged*.

I.3.3 Laser Emission and Classification

Governmental standards and requirements specify that the laser must be classified according to the output power or energy and the laser wavelength.

The OBIS Laser is classified by the United States National Center for Device and Radiological Health (CDRH) as Class 3B based on 21 CFR, Subchapter J, Part 1040, section 1040.10 (c) and/or IEC/EN 60825-1, Clause 5. In this manual, the classification will be referred to as Class 3B.

It may emit VISIBLE or INVISIBLE LASER RADIATION wavelengths of 0.3 to 1.0 µm from the aperture in the front of the laser.

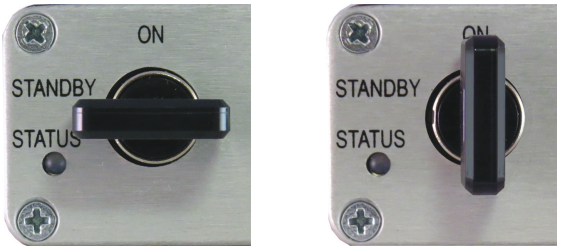
I.3.4 Protective Housing

Laser radiation is fully contained within a protective housing, other than for the laser beam aperture (OBIS without fiber) or the fiber exit (OBIS with fiber). ***Never open the protective housing***.

WARNING!
Use of controls or adjustments or performance of procedures other than those specified in the manual may result in hazardous radiation exposure.

I.3.5 Key Control

The OBIS 6-Laser Remote has a keyswitch that, in STANDBY position, prevents the generation of laser radiation. Laser radiation can occur when the key is in the ON position. The key is removable when in the STANDBY position, but *not* in the ON position, as shown in Figure I-1.



STANDBY Position *ON Position*

Figure I-1. OBIS Remote Keyswitch

The keyswitch acts as the CDRH Manual Reset feature. After an interlock fault or power interruption, the laser will not auto restart (the Status LED indicator will be blinking blue), unless the keyswitch is first reset to STANDBY and then set back to ON. Figure I-6 shows the keyswitch circuit information.

WARNING!
When the keyswitch is in the ON position and the interlock plug is connected, there can be laser emission.

The Status light emitting diode (LED) indicator on the front panel displays green, blue, or red, as determined by the state of the OBIS Remote. For additional information about laser status LEDs, see "OBIS Laser and Remote Status Indicators" (p. 17).

Table I-3 lists the LED indicator on the OBIS 6-Laser Remote. For more information about operation of this Remote, see Part 2 of the *OBIS LX/LS Operator's Manual*.

Table I-3. OBIS Remote Keyswitch Status LED Indicator

LED Color	Keyswitch Position	Interlock Status
Yellow	Not Applicable - Initialization	Not Applicable
Blinking Blue	Error: Keyswitch was ON at power-up. Toggle keyswitch back to STANDBY to clear the error.	Not Applicable
Blue	STANDBY	Not Applicable
Green	ON	Closed
Red	ON	Interlock Open, causing a Fault

NOTE:
OBIS Single-Laser Remote units shipped before 2012 may not have the Status LED indicator that has been incorporated into the latest design.

I.3.6 Laser Emission Indicator

The laser system OBIS 1-Laser Remote includes a laser emission indicator as shown in Figure I-2. This is labeled ‘CAUTION’ on the front panel.

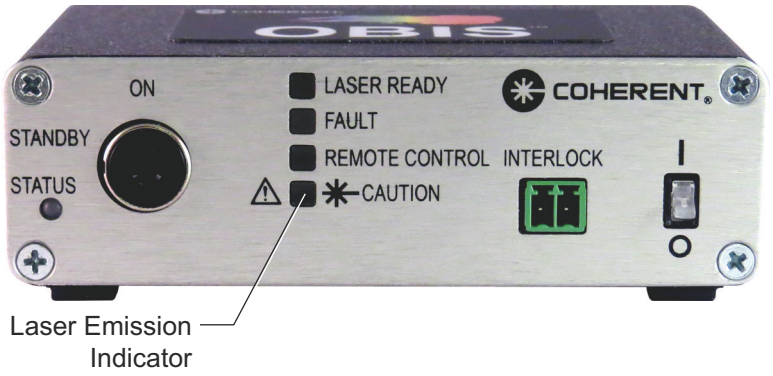


Figure I-2. Laser Emission Indicator

- When the white LED emission indicator is not illuminated, laser radiation is not possible.
- When the indicator is illuminated, consider the laser dangerous. A laser beam can be created at any moment (by computer control, for example).

After the illumination of the white LED emission indicator, there is a delay until actual laser emission. This delay gives time to take action to prevent exposure to the laser beam. The delay is at least five seconds.

NOTICE

The LED indicator on the front panel of the OBIS 6-Laser Remote is NOT a laser emission indicator, but an indicator for the status of the Remote.

For the OBIS 6-Laser Remote, the laser emission indicators are the illuminated Power ON/OFF switches that indicate there is power and possible laser emission for each channel. Each laser has its own indicator, as shown in Figure I-3.

Figure I-3. OBIS 6-Laser Remote Power ON/OFF Switches

I.3.7 Shutter

The OBIS Laser has a manually-operated shutter at the beam exit aperture on the front of the laser, as shown in Figure I-4.

When the shutter is closed, there is no laser radiation sent from the laser.

The OBIS fiber-pigtailed laser has a metal shutter cap (rather than a mechanical shutter), as shown in Figure I-5. When the shutter cap is closed, there is no laser radiation sent from the laser.

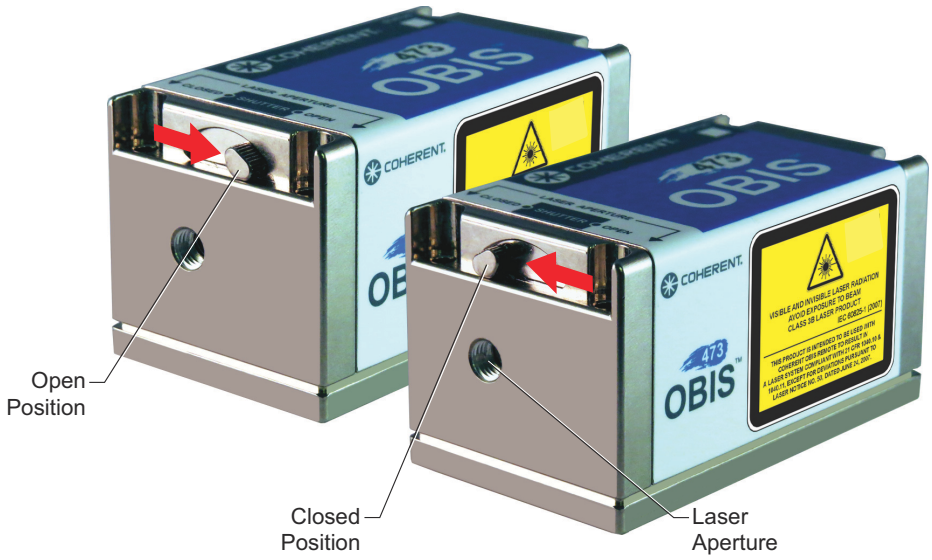


Figure I-4. Shutter in Open and Closed Positions

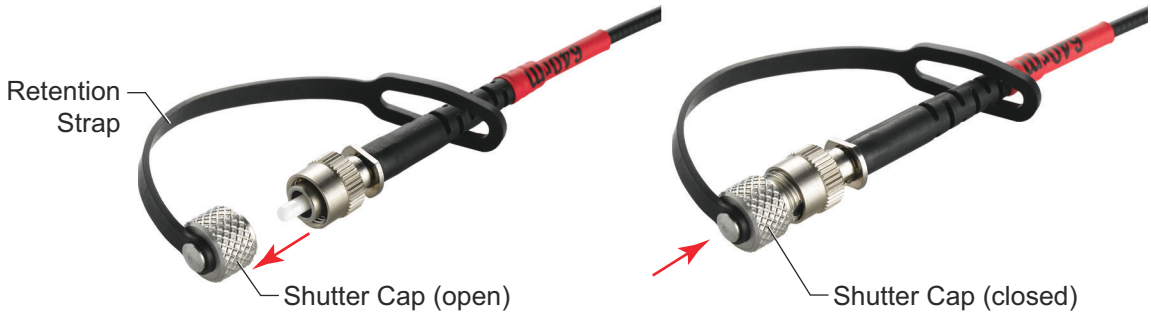


Figure I-5. OBIS FP Shutter Cap in Open and Closed Position

CAUTION!
OBIS FP (fiber pigtail): Always use Nitrile gloves when handling the fiber—DO NOT touch the laser fiber output!

OBIS FP: Open fiber end in an environment that is free of organic material and particulates. The fiber end is susceptible to contamination that can cause fiber degradation.

Before the laser is turned ON, the surface of the fiber tip must be checked for contamination. If contamination cannot be excluded, the fiber tip must be cleaned using designated tools for fiber cleaning that do not damage the fiber tip.

For more information, refer to “Step 8: Clean the OBIS Fiber Tip” (p. 53).

I.3.8 Remote Interlock

The OBIS Remote, the OBIS 6-Laser Remote, the OBIS Scientific Remote, and the OBIS Laser Box have a remote interlock circuit that, when open, prevents the generation of laser radiation. This interlock circuit is fail-safe or redundant.

Figure I-6 shows a diagram of the remote interlock circuit configuration. The remote interlock is applicable to OBIS LX and OBIS LS systems.

I.3.9 CW-Only-Mode Versions for OBIS LX Lasers

If your OBIS LX laser is a **CW-Only-Mode** laser and/or the Serial Number has 'CW' in the number, then the laser is intended to be operated only in the CW-Power mode or CW-Current mode.

CAUTION!
If you have a CW-Only-Mode laser, then:
*** Do *not* operate the laser in Analog Modulation Mode!**
*** Do *not* operate the laser in Digital Modulation Mode!**
*** Do *not* operate the laser in Mixed Modulation Mode!**

If the CW-Only-Mode laser is set to a Modulation Mode, the laser output power could be a maximum of 110%.I

NOTICE
The customer provided modulation input signals will not change the potential maximum 110% output power condition when laser emission is enabled.

CW-Only-Mode laser can be operated as described in this Operator's Manual using Coherent Connection, an OBIS Remote, or USB communication to turn the laser ON and OFF to control emissions.

I.4 Compliance with Government Requirements

The OBIS Laser is an OEM product designed to be integrated into other equipment, and as a standalone part, may not comply with some government requirements, as described in this section.

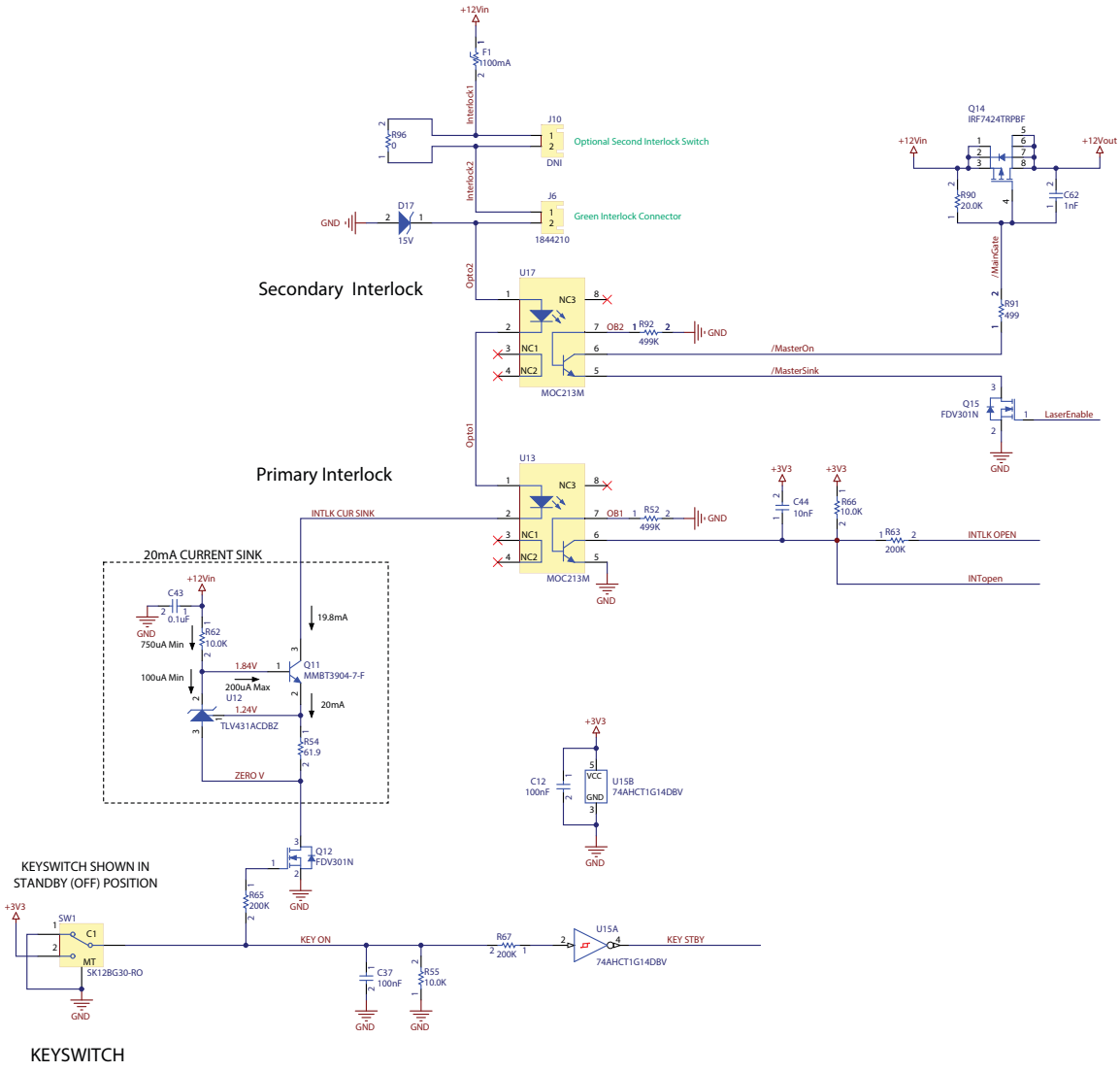


Figure I-6. Remote Interlock Circuit and Keyswitch Diagram for Controllers

The following government requirements must be considered in the process of integrating the OBIS Laser product.

I.4.1 CDRH/IEC 60825-1 Compliance

When used with the OBIS Remote, the OBIS Laser complies with Center for Devices and Radiological Health (CDRH) (21 CFR 1040.10 and 1040.11, except for deviations pursuant to laser notice no. 50, dated July26, 2001) and International Electrotechnical Commission (IEC) 60825-1.

I.4.1.1 Europe

The European Community requirements for product safety are specified in the Low Voltage Directive (LVD) (published in 2014/35/EU).

The Low Voltage Directive requires that lasers comply with the standard EN 61010-1/IEC 61010-1 "Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use" and EN 60825-1/ IEC 60825-1 "Safety of Laser Products".

Compliance of this laser with the European requirements (apart from EN60825-1/IEC60825-1) is certified by the CE Mark.

I.4.1.2 United States

The applicable United States Government requirements are contained in 21 CFR, Subchapter J, Part 1040 administered by the Center for Devices and Radiological Health (CDRH).

For OBIS LX and OBIS LS lasers, the CDRH Accession Number is 1110019 (current as of the publication date of this document).

CAUTION!
As a stand-alone product, the laser does not fully comply with requirements for certified laser products as defined in the US FDA CFR 21, sections 1040.10 and 1040.11, or the IEC 60825-1:2014 standard.

This laser system is not intended to be used as a stand-alone application. Instead, it can be used with an OBIS Remote or integrated into a laser product by an OEM using appropriate end-user safety mechanisms. It is the responsibility of the integrator to meet all CDRH/IEC compliance requirements.

When used with a Coherent OBIS Remote, this combination results in a laser system that conforms to performance standards for laser products under 21 CFR 1040, except with respect to characteristics authorized by Variance #FDA-2017-V-2596, dated 23 May 2017.

I.4.2 Declaration of Conformity

Declaration of Conformity certificates are available upon request. Contact your Coherent representative or Coherent Technical Support as follows:

- By email: customer.support@coherent.com
- Visit our website: www.Coherent.com

- By phone: +**1-(734) 456-3100**

I.4.3 Environmental and Safety Compliance

In addition to complying with CDRH and IEC 60825-1 requirements, the OBIS family of products has been certified by an outside testing lab to be in compliance with the environmental and safety directives listed in this section.

I.4.3.1 EMI Standard for Emissions per:

CISPR 11:2015 + A1:2016 (for OBIS LS)
Class A Radiated Emissions

CISPR 11:2015 + A1:2016 (for OBIS LS)
Class A Conducted Emissions

IEC61000-3-2:2014
Power Line Harmonics

IEC 61000-3-3:2013
Power Line Voltage Fluctuation and Flicker

I.4.3.2 EMC Standard for Immunity per:

IEC 61326-1:2012

IEC 61000-6-2:2005
Electrostatic Discharge – Performance Criteria B
Radiated Immunity – Performance Criteria A
Electrical Fast Transient Immunity – Performance Criteria B
Electrical Slow Transient Immunity – Performance Criteria B
Conducted RF Immunity – Performance Criteria A
Power Line Interruptions, Dips, and Dropouts – Performance Criteria B

I.4.3.3 Low Voltage Directive 73/23/EEC Tests per:

EN61010-1:2010
Safety Requirements Part 1: General Requirements

I.4.3.4 Machinery Directive for Laser Devices Tests per:

IEC 60825-1:2014
Safety of Laser Products – Part 1: Equipment Classification Requirement and User's Guide

IEC 60825-2:2005
Safety of Laser Products – Part 2: Safety of Optical Fiber Communication Systems

IEC 60825-12:2004
Safety of Laser Products – Part 12: Safety of Free Space Optical Communication Systems Used for Transmission of Information

21CFR 1040.10
Code of Federal Regulations Title 21 - FDA

I.4.4 REACH

Coherent product(s) conform to all applicable requirements of the EU-REACH Regulation, (1907/2006). Compliance Declarations are available upon request.

I.4.5 RoHS Compliance

The RoHS directive restricts the use of certain hazardous substances in electrical and electronic equipment.

Coherent product(s) conform to all applicable requirements of the EU-RoHS Directive (2011/65/EU) and Amendment Directive (EU) 2015/863. Compliance Declarations are available upon request.

Compliance with the EMC requirements is certified by the CE mark.

I.4.6 China RoHS Compliance

Coherent product(s) conform to all applicable requirements of Restriction of Hazardous Substances Regulation SJ/T 11364-2014, commonly referred to as China RoHS.

Hazardous substances (if applicable) in the OBIS Laser System are listed on the label, shown in the example in Figure I-7.

Also, the China RoHS directive requires that the date of manufacture (in Chinese characters) for the OBIS Laser System be shown on the product. This is done on the conforming/nonconforming label, shown in Figure I-8.

Figure I-7. China RoHS Table of Restricted Hazardous Substances

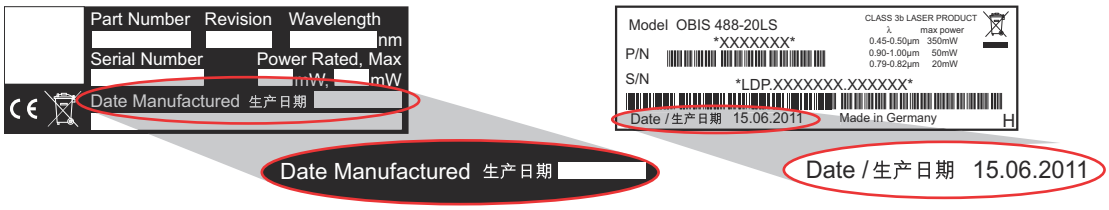


Figure I-8. China RoHS Date of Manufacture

I.4.7 Waste Electrical and Electronic Equipment (WEEE)

Coherent product(s) conform to all applicable requirements of the EU Waste Electrical and Electronic Equipment (WEEE)- Directive (2012/19/EU). WEEE management also covers EU Directive 2006/66/EC-EU Battery Directive and Directive 94/62/EC on Packaging and Packaging Waste.

The purpose of the European Waste Electrical and Electronic Equipment (WEEE) Directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection. The crossed-out garbage container label, shown in Figure I-9, is affixed to the cover of the OBIS Laser.

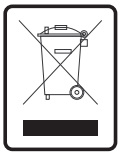


Figure I-9. Waste Electrical and Electronic Equipment Label

Do not dispose of these products or packaging as unsorted municipal waste. Contact Coherent or the local distributor for procedures for recycling this equipment. For further information about Coherent Compliance, please visit:
https://www.coherent.com/company/environmental

I.5 Safety Labels

The following figures show the location of product labels. These include warning labels indicating apertures through which laser radiation is emitted, as well as labels of certification and identification [21 CFR § 1040.10(g), 21 CFR § 1010.2, and 21 CFR § 1010.3/ EN 60825-1/IEC 60825-1, Clause 7].

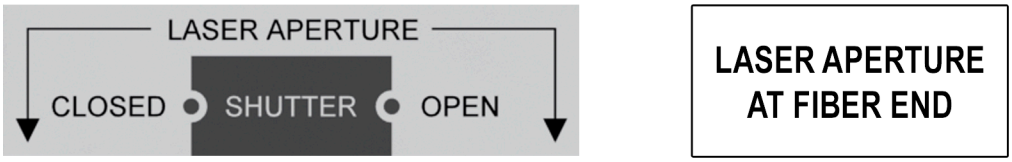
Figure I-10 shows the location of the safety labels on the OBIS laser.

Figure I-10. Safety Labels on the OBIS Laser

Figure I-11 shows the wording on the Laser Safety label.

Figure I-11. Laser Safety Label

Figure I-12 shows labels that indicate locations for the laser aperture.



OBIS OBIS FP

Figure I-12. Labels for Laser Aperture Locations

Figure I-13 shows examples of product-specific information, including the part number, serial number, date of manufacture, power and wavelength for each laser.

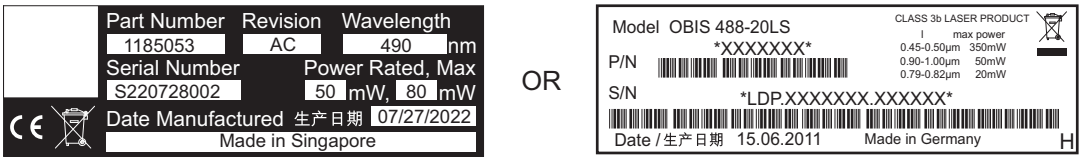


Figure I-13. Product-Specific Information Examples

II APPENDIX - LASER BACK REFLECTION

This section describes laser back reflection and tells how to prevent damage or noise caused by back reflection.

NOTICE

***Back reflection* (also referred to as *retroreflection*) occurs when a part of the laser beam is sent back into the laser's exit aperture. Back reflection can be caused by any object in front of the laser and can result in instability, noise, or damage to the laser.**

In a normal application the laser beam exits the beam aperture and none of the light from the laser is reflected back. Ideally 100% of the output power from the laser is used in the application and none of the light is scattered or sent back into the laser exit aperture.

WARNING!

Always wear correct laser safety eyewear and follow laser safety precautions when using the procedures described in this document.

Figure II-1 shows the location of the laser exit aperture on some Coherent products.

The amount of back reflection that can damage a laser diode changes from device-to-device. Sometimes a back reflection as low as 4% of the total beam power is sufficient to cause damage.

Damage from back reflection can be immediate, or it can be subtle and slowly decrease the service life of the laser.

Indications that back reflections are causing permanent damage to the laser diode include:

- No output power
- Low output power
- Over-current of the laser diode

Back reflection can also cause the output power noise (RMS noise and Peak-to-Peak noise) to increase if the reflection interferes with the laser cavity or light-loop.

Figure II-1. Exit Aperture Locations

Figure II-2 shows a laser beam hitting an object and reflecting part of the beam back into the laser exit aperture.

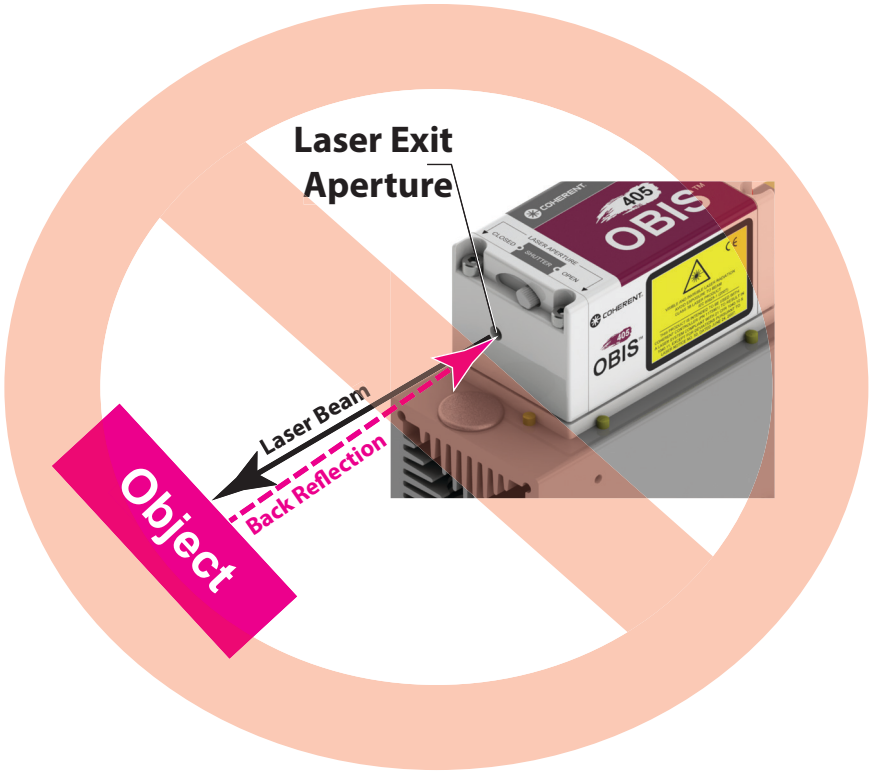


Figure II-2. Laser Back Reflection

CAUTION!
Avoid any condition where the laser beam—or any part of the laser beam—reflects back into the laser exit aperture.

Coherent recommends that the laser light be reflected away from the laser exit aperture to a safe beam dump (absorber), as shown in Figure II-3.

The following procedure describes how to prevent a strong back reflection and possible damage to the laser:

1. Use the USB or RS-232 controls to set the power at 10% of the rated output power before opening the laser aperture.
2. Do optical or laser alignment at this low output power to confirm there are no back reflections.

Sources of back reflections include:

- Fiber, Fiber Ferrule, or Fiber Connector
- Optical Filters that are not angled but are perpendicular to the beam
- Neutral Density Glass or Beam Attenuators that have a front surface reflection that can create a back reflection.

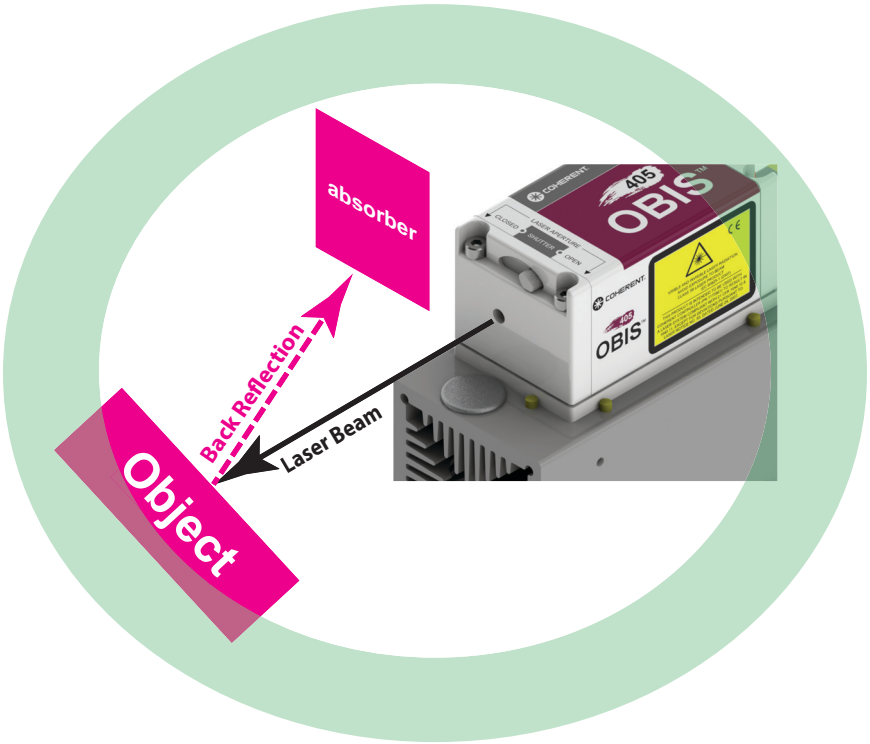


Figure II-3. Reflect Laser Light Away from Laser Exit Aperture

- Beam Block at normal incidence that reflects power back into the laser
- Plano-concave or Plano-convex lenses where the flat surface reflects back part of the beam
- Power measurement probes that use a reflective attenuator or have a surface that reflects the laser light.
- Mirrors or other shiny surfaces from mounts or other optical components in the beam path.

When measuring laser power with a power meter, always angle the power sensor so that the laser beam does not reflect back into the laser exit aperture.

To properly measure laser power:

1. Take the measurement near the laser.
2. Move the power sensor to maximize the reading of the output power. ***DO NOT let this movement and alignment create a back reflection***.

In many cases an object is positioned in front of the laser as a beam block. Make sure the object is not reflective and does not create a back reflection to the laser.

If you cannot adjust your application to decrease the back reflection of the laser light into the laser's exit aperture, add an optical isolator to protect the laser. Although the optical isolator adds cost and requires additional space, it can be an appropriate safety factor to increase the life of the laser.

Be aware of every optical surface in front of the laser. All object have the opportunity to create a back reflection. In many cases the front surface and the back surface of the optic are a source of back reflection. Figure II-4 shows a set-up that might cause back reflection damage.

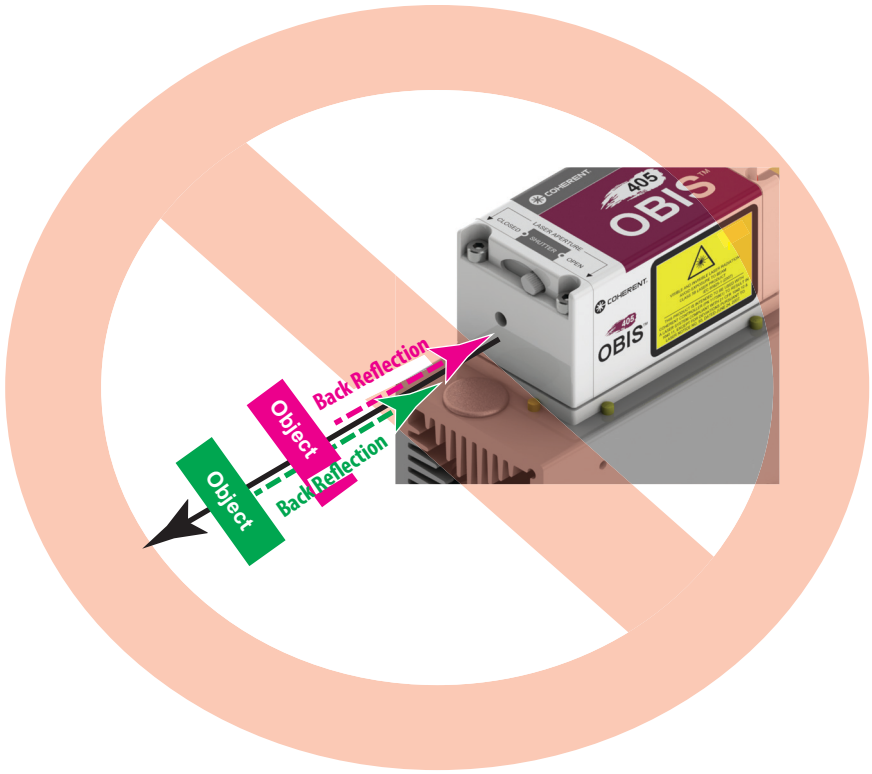


Figure II-4. Incorrect Set-Up Causes Laser Back Reflection Damage

The set-up shown in Figure II-5 is safer than the set-up in the previous illustration because both objects are set at a slight angle to the laser. This change of angle sends the back reflection away from the laser exit aperture.

With any optic or object, the angle of incident can impact the optics performance or function. Review the specifications for each optical element to understand how much angle is acceptable.

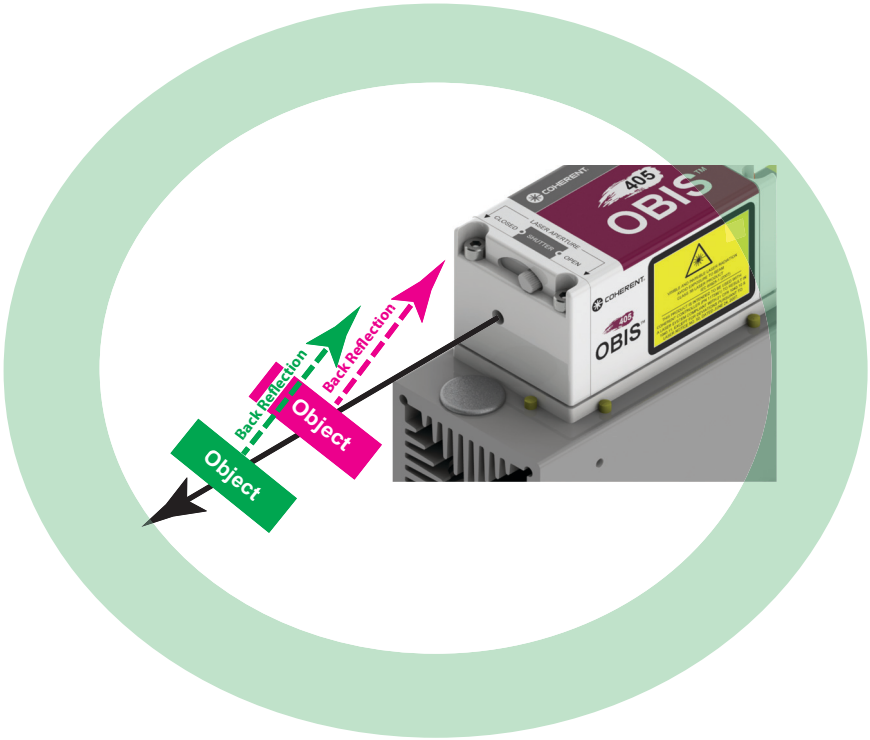


Figure II-5. Safer Laser Set-Up

- The closer the object is to the laser, the more angle is needed to direct the back reflection away from the laser exit aperture.
- The farther the object is away from the laser, the less angle is needed to direct the back reflection away from the laser exit aperture.

The OBIS XF SF laser diode does not incorporate an optical isolator, so may be highly susceptible to extraneous optical feedback. This can cause damage that may result in a loss of power, reduction to the life of the laser, or a loss of spectral characteristics such as center wavelength and line-width.

It is highly recommended that you use an optical isolator and ensure that all reflective surfaces in the optical path are angled to avoid direct feedback into the laser.

- Turn power level down to 5-10% of nominal before beginning alignment procedure. Do not focus the light output on any highly reflective surface.
- When using wavelength-selective filters with narrow wavelength pass bands, do not align at normal incidence to the beam.
- Use caution when aligning the laser; for example, when sweeping the beam back across the laser during alignment. If such action is

unavoidable, use a sufficient OD filter (or isolator) at the output of the laser during the alignment process.

Sufficient optical feedback to the laser overcomes the grating-induced stabilization, which unlocks and shifts the wavelength of the laser beyond the pass band of the filter. This dramatically increases the reflected intensity back into the laser and can cause damage.

II.1 Summary

- Review the objects in front of the laser and note which surfaces are a possible hazard for back reflections. Change the objects to be less reflective whenever possible. Adding Anti-Reflective (AR) coatings to optics and more diffuse surfaces to mounts or beam shutters can help.
- If possible, add an angle to the object so that the reflection does not enter the laser exit aperture.
- Take precautions when moving objects that can create a back reflection in front of the laser.
- Decrease the power from any possible back reflections by starting the laser at lower output power—for example 10% output power—before opening the laser shutter.
- ***Using correct safety precautions***, watch where the reflections from objects are returning to make sure the reflections are not at or near the laser exit aperture.
- Take extra precautions when using a laser power meter— consider how close the measurement is being taken to the laser and the angle at which the beam can reflect off the sensor so that it doesn't reflect back into the laser.
- A laser that shows low output power, no output power, over-current, or high noise, indicates a possibility that there is a back reflection to the laser.
- Add an optical isolator to those applications that have laser exit aperture back reflections that cannot be corrected by angling the optics.

III APPENDIX - PARTS & ACCESSORIES

This section lists the accessories you can order for the OBIS laser system.

Coherent product information and related software is now available in one easily accessible location on the Coherent website. Filter your search by product type, document category, or both. To download manuals and software, go to:

https://www.coherent.com/resources

Order these parts as follows:

- Send an e-mail to: customer.support@coherent.com
- Visit our website: www.Coherent.com or contact your local Coherent service representative
- By phone: **+1 (734) 456-3100**

When communicating with the Technical Support Department either via the web or telephone, the Support Engineer responding to your request requires the Coherent part number and the product serial number.

Should you need further assistance, contact Coherent Technical Support; see “Appendix - Service & Support” (p. 201).

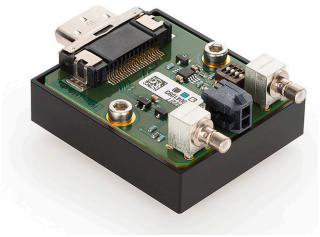
III.1 Laser System Remotes

Table III-1 lists the Remotes that you can order for the OBIS laser system.

Table III-1. Parts List: Remotes

Image	Part Number	Description
	**OBIS LX/LS Single Laser Remote** with full features for control with Analog and Digital modulation inputs. Includes USB and RS-232 connectors on the back panel of the Remote.	
	1173961	OBIS LX/LS Single Laser Remote, with Power Supply, USB cable, and Coherent Connection applications software. (No SDR Laser-to-Remote cable.)
	1214875	OBIS LX/LS Single Laser Remote, with Power Supply, 1 meter laser-to-remote (SDR) cable, USB cable, and Coherent Connection applications software.
	**OBIS LX/LS 6-Laser Remote with CDRH features**. Separate power switches and power cables for each laser. ***NOTE:*** Does not support modulation inputs.	
	1203909	OBIS LX/LS 6-Laser Remote, with Power Supply, 6 power cables from laser-to-remote, and Coherent Connection applications software.
	1306263	OBIS LX/LS 6-Laser Remote, with Power Supply and Coherent Connection applications software (no laser-to-remote power cables).
	1211389	OBIS 6-Laser Power Supply, 110V/220 VAC, 12 VDC, IEC-320 input (does not include power cord to wall; order separately)
	**OBIS LX/LS Scientific Remote** with full features for control with analog/digital inputs for up to six lasers. User interface touch screen and connectivity through USB, RS-232, and Ethernet.	
	1234465	OBIS LX/LS Scientific Remote, with internal Power Supply, and Coherent Connection applications software (no SDR Laser-to-Remote cables).
	1234466	OBIS LX/LS Scientific Remote, with internal Power Supply, 6 laser-to-remote (SDR) 1-meter cables, and Coherent Connection applications software.

Table III-1. Parts List: Remotes (Continued)

Image	Part Number	Description (Continued)
	**OBIS LX/LS Laser Box** with five laser mounting bays with thermal management, cooling fans, analog/digital inputs, RS-232, USB, key-switch, and interlock in one compact package. Lasers sold separately.	
	1228877	OBIS LX/LS Laser Box, with Power Supply, USB cable, and Coherent Connection applications software. Analog Modulation Impedance = 2k Ω, Digital Modulation Impedance = 50 Ω.
	1343229	OBIS LX/LS Laser Box, with Power Supply, USB cable, and Coherent Connection applications software. Analog Modulation Impedance = 2k Ω, Digital Modulation Impedance = 2k Ω.
	**OBIS LX/LS Modulation Interface**, Analog and Digital Modulation, SDR. Compact board-level Modulation Interface. SMB connector for Analog Modulation control input. SMB Connector for Digital Modulation control input. Plugs directly into OBIS laser.	
	1319290	OBIS LX/LS Modulation Interface, Analog and Digital Modulation, SDR. Compact and easy-to-use, this OBIS Modulation Interface offers separate SMB input for Analog and Digital Modulation. This accessory works with all OBIS LS and LX lasers. • Modulation Interface plugs directly into the OBIS Laser. • Analog Modulation can be set for a 50 Ω or 2K Ω input impedance. • Digital Modulation can be set for a 50 Ω or 2K Ω input impedance. • Digital Modulation can also be set to operate with Laser ON at 3.3 Volts or Laser ON at 5 Volts. Modulation interface must be connected to the OBIS Power Supply, sold separately to then power the interface and laser together. • Dimensions (W x H x L): 40 x 20 x 120 mm (with laser).
	1197523	OBIS SDR Cable, laser-to-remote, 0.3 meter
	1179451	OBIS SDR Cable, laser-to-remote, 1 meter
	1179858	OBIS SDR Cable, laser-to-remote, 3 meters

III.2 Accessories

Table III-2 lists the Accessories that you can order for the OBIS laser system and Remotes.

Table III-2. Parts List: Accessories

Image	Part Number	Description
	1193289	**OBIS Heatsink** with fan for thermal management, includes hardware to mount to table. Laser can be mounted on top or side for horizontal polarization. Convenient 69 mm (2.7 inch) beam height.
	1190901	**OBIS Interlock Laser Warning Light** Assy for OBIS Remote
	1190348	**OBIS Accessory Spare Parts for OBIS Remote** (includes power cable, I/O cable, keys, labels, and interlock)

III.3 Cables and Power Supplies

Table III-3 lists the cables and power supplies that you can order for the OBIS laser system.

Table III-3. Parts List: Cables and Power Supply

Part Number	Description
1184491	OBIS Power Supply, 110V/220 VAC, 12 VDC, IEC-320 input (does not include power cord to wall)
1214874	OBIS Power Supply, 110V/220 VAC, 12 VDC, IEC-320 input (includes USA power cord)

Table III-3. Parts List: Cables and Power Supply

Part Number	Description (Continued)
1190582	OBIS Power Cable to Flying Leads, 2-pin plug-and-socket
1106344	Power Cord, USA, wall plug to IEC-60320 plug, 8 foot
1150025	Power Cord, European, wall plug to IEC-60320 plug, 8 foot
2221647	Power Cord, Japan, wall plug to IEC-60320 plug, 8 foot
1108906	USB Cable, 1.8 meter (USB Type A to Type Mini B)

III.4 Bandpass Filter

OBIS LX/LS Bandpass Filter can reduce noise in fluorescent applications that are sensitive to longer wavelength emissions.

OBIS LX/LS Bandpass Filter conveniently threads into the front of the OBIS LX laser to remove long wavelength emissions. Bandpass filter is specifically mounted to avoid internal retro-reflection from the filter.

Table III-4 lists the filters that you can order for the OBIS laser.

Table III-4. Parts List: Filters

Image	Part Number	Description
	1265259	**BANDPASS FILTER, 445 nm, OBIS LX, Pass 423-468 nm** Transmission of > 90% from 423 nm to 468 nm. Blocking with < 0.01% from 500 nm to 600 nm. Damage Threshold > 1000 W/cm2 at 445 nm.
	1265260	**BANDPASS FILTER, 473 nm, OBIS LX, Pass 468-478 nm** Transmission of > 90% from 468 nm to 478 nm. Blocking with < 0.01% from 500 nm to 600 nm. Damage Threshold > 1000 W/cm2 at 473 nm.
	1263515	**BANDPASS FILTER, 488 nm, OBIS LX, Pass 485-491 nm** Transmission of > 90% from 485 nm to 491 nm. Blocking with < 0.01% from 500 nm to 800 nm. Damage Threshold > 1000 W/cm2 at 488 nm.
	1202061	**BANDPASS FILTER, 633 nm 637nm, OBIS LX, Pass 630-642 nm** Transmission of > 90% from 630 nm to 642 nm. Blocking with < 0.01% at 488 nm. Blocking with < 0.1% at 652 nm to 660 nm. Blocking with < 0.01% at 660 nm to 670 nm.
	1202062	**BANDPASS FILTER, 640 nm, OBIS LX, Pass 635-645 nm** Transmission of > 90% from 635 nm to 645 nm. Blocking with < 0.01% from 483 nm to 493 nm. Blocking with < 0.1% at 652 nm to 660 nm. Blocking with < 0.01% at 660 nm to 670 nm. Damage Threshold > 25 W/cm2 at 405 nm.

IV APPENDIX - OBIS LX OPERATING HUMIDITY RANGE

(*LX lasers only*) The OBIS Laser includes an active thermoelectric cooler to maintain the diode and optics at 25°C. The humidity and ambient temperature around the laser need to be considered to prevent condensation on the diode and optics. Table IV-1 shows the dew point.

The diode set temperature is 25ºC. Dew points above 25ºC (shaded in blue) can cause concern for condensation.

Table IV-1. Safe Operating Humidity Levels (LX lasers only)

Air Temp (ºC)	Relative Humidity (%)																		
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
45	45.0	44.0	43.0	41.9	40.7	39.5	38.2	36.9	35.4	33.8	32.1	30.3	28.2	25.9	23.4	20.4	16.8	12.3	6.3
44	44.0	43.0	42.0	40.9	39.8	38.5	37.3	35.9	34.5	32.9	31.2	29.4	27.3	25.1	22.5	19.5	16.0	11.6	5.6
43	43.0	42.0	41.0	39.9	38.8	37.6	36.3	35.0	33.5	32.0	30.3	28.5	26.5	24.2	21.6	18.7	15.2	10.8	4.8
42	42.0	41.0	40.0	38.9	37.8	36.6	35.4	34.0	32.6	31.1	29.4	27.6	25.6	23.3	20.8	17.9	14.4	10.0	4.1
41	41.0	40.0	39.0	38.0	36.8	35.7	34.4	33.1	31.7	30.1	28.5	26.7	24.7	22.5	19.9	17.0	13.5	9.2	3.3
40	40.0	39.0	38.0	37.0	35.9	34.7	33.5	32.1	30.7	29.2	27.6	25.8	23.8	21.6	19.1	16.2	12.7	8.4	2.6
39	39.0	38.0	37.0	36.0	34.9	33.7	32.5	31.2	29.8	28.3	26.6	24.9	22.9	20.7	18.2	15.4	11.9	7.6	1.8
38	38.0	37.1	36.1	35.0	33.9	32.8	31.6	30.2	28.9	27.4	25.7	24.0	22.0	19.8	17.4	14.5	11.1	6.8	1.1
37	37.0	36.1	35.1	34.0	33.0	31.8	30.6	29.3	27.9	26.4	24.8	23.1	21.1	19.0	16.5	13.7	10.3	6.1	0.3
36	36.0	35.1	34.1	33.1	32.0	30.8	29.6	28.4	27.0	25.5	23.9	22.2	20.2	18.1	15.7	12.8	9.5	5.3	-0.4
35	35.0	34.1	33.1	32.1	31.0	29.9	28.7	27.4	26.1	24.6	23.0	21.3	19.4	17.2	14.8	12.0	8.7	4.5	-1.2
34	34.0	33.1	32.1	31.1	30.0	28.9	27.7	26.5	25.1	23.7	22.1	20.4	18.5	16.3	13.9	11.2	7.8	3.7	-1.9
33	33.0	32.1	31.1	30.1	29.1	28.0	26.8	25.5	24.2	22.7	21.2	19.5	17.6	15.5	13.1	10.3	7.0	2.9	-2.7
32	32.0	31.1	30.1	29.2	28.1	27.0	25.8	24.6	23.2	21.8	20.3	18.6	16.7	14.6	12.2	9.5	6.2	2.1	-3.4
31	31.0	30.1	29.2	28.2	27.1	26.0	24.9	23.6	22.3	20.9	19.3	17.7	15.8	13.7	11.4	8.6	5.4	1.3	-4.2
30	30.0	29.1	28.2	27.2	26.2	25.1	23.9	22.7	21.4	20.0	18.4	16.8	14.9	12.8	10.5	7.8	4.6	0.5	-4.9

Table IV-1. Safe Operating Humidity Levels (LX lasers only) (Continued)

Air Temp (ºC)	Relative Humidity (%)																		
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
29	29.0	28.1	27.2	26.2	25.2	24.1	23.0	21.7	20.4	19.0	17.5	15.8	14.0	12.0	9.7	7.0	3.8	-0.3	-5.7
28	28.0	27.1	26.2	25.2	24.2	23.1	22.0	20.8	19.5	18.1	16.6	14.9	13.1	11.1	8.8	6.1	2.9	-1.1	-6.5
27	27.0	26.1	25.2	24.3	23.2	22.2	21.0	19.8	18.6	17.2	15.7	14.0	12.2	10.2	7.9	5.3	2.1	-1.8	-7.2
26	26.0	25.1	24.2	23.3	22.3	21.2	20.1	18.9	17.6	16.2	14.8	13.1	11.3	9.3	7.1	4.4	1.3	-2.6	-8.0
25	25.0	24.1	23.2	22.3	21.3	20.3	19.1	18.0	16.7	15.3	13.8	12.2	10.5	8.5	6.2	3.6	0.5	-3.4	-8.7
24	24.0	23.1	22.3	21.3	20.3	19.3	18.2	17.0	15.7	14.4	12.9	11.3	9.6	7.6	5.3	2.8	-0.4	-4.2	-9.5
23	23.0	22.2	21.3	20.3	19.4	18.3	17.2	16.1	14.8	13.5	12.0	10.4	8.7	6.7	4.5	1.9	-1.2	-5.0	-10.3
22	22.0	21.2	20.3	19.4	18.4	17.4	16.3	15.1	13.9	12.5	11.1	9.5	7.8	5.8	3.6	1.1	-2.0	-5.8	-11.0
21	21.0	20.2	19.3	18.4	17.4	16.4	15.3	14.2	12.9	11.6	10.2	8.6	6.9	4.9	2.8	0.2	-2.8	-6.6	-11.8
20	20.0	19.2	18.3	17.4	16.4	15.4	14.4	13.2	12.0	10.7	9.3	7.7	6.0	4.1	1.9	-0.6	-3.6	-7.4	-12.5

Shaded areas in the table represent condensing. For example, with the cold block at 25°C and the air temperature 30°C with 80% relative humidity, the condition is condensing. At 70% relative humidity, it is no longer condensing.

V APPENDIX - BEAM PROPAGATION

In this section:

This section provides basic optics information to consider when designing a beam delivery system. In addition, this section describes the properties of the beam.

WARNING!
Always wear laser safety glasses when aligning the OBIS laser to an optical assembly.

CAUTION!
Avoid back reflections when aligning the OBIS. As little as 5% back reflection can damage the diode. See “Appendix - Laser Back Reflection” (p. 147) for additional precautions and safety instructions.

V.1 Beam Diameter

The typical Coherent OBIS laser beam is very close to an ideal Gaussian beam profile, where the peak intensity of the beam is at the center.

The intensity profile cutting through a laser beam shown in Figure V-1 is illustrated for an ideal case.

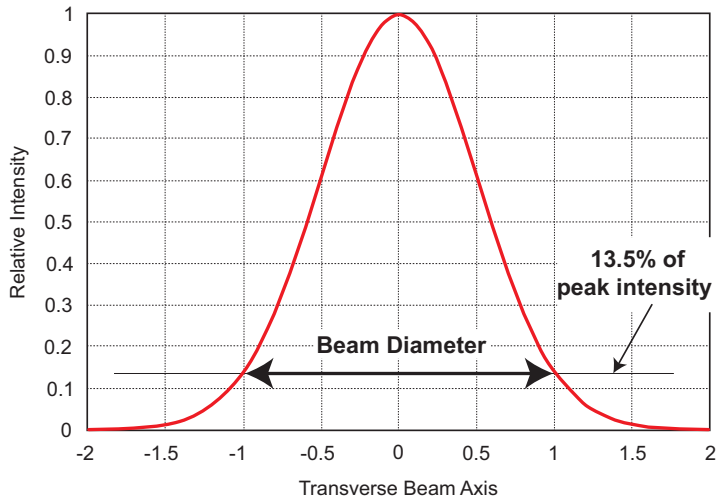


Figure V-1. Gaussian Beam Profile

For these beams, the beam diameter is defined as the width of the beam, where the intensity is 13.5% of the peak intensity. Based on the mathematical description of the beam profile, this is a good first approximation of beam diameter.

The practical information here is selecting the clear aperture of optics that the laser beam must go through. To allow at least 99% of the laser beam though an aperture, it should be at least 1.5 times the beam diameter at that point. In actual practice, the clear aperture should be selected to be several millimeters larger so it is easy to align the beam through the optic.

The laser beam information in data sheets is based on measurements using specific instruments designed to measure beam diameters.

V.1.1 M^2 (M Squared) Factor

The actual laser beams differ somewhat from the ideal Gaussian profile shown in Figure V-1, above.

To handle the handle the deviation from the ideal case, the factor M^2 or K has been developed and is often quoted in laser specifications. It basically relates to the factor by which the beam diameter is different from ideal.

- For the ideal beam, the M^2 factor is 1 and the factor increases as the beam deviates more from ideal behavior.
- For a beam with an M^2 factor of 1.2, the beam is actually $\sqrt{1.2} = 1.1$ larger than an ideal Gaussian beam.

As shown in later examples, this has practical use to determine the beam size at various locations in a beam delivery system. Note that the $M^2 = 1/K$ and is also in common use.

V.1.2 Beam Propagation

As a laser beam propagates away from it narrowest point or beam waist, it increases in size in a very predictable fashion.

To calculate the beam size at a specific location, one must know the size of the beam waist and its location. Thus the beam diameter *D*, at a distance *Z* away from the beam waist, with a beam waist diameter of D_0 follows the equation:

$$D = \sqrt{D_o^2 + \Theta^2 Z^2}$$

The factor Θ is the beam divergence. The beam divergence depends on some basic properties of the beam, including the wavelength and the beam waist size D_0. The relationship for the beam divergence at full angle is:

$$\Theta = \frac{4\lambda M^2}{\pi D_o}$$

Often the beam divergence is a value included in the specifications of a laser. If a calculation is being made of the divergence, the units of the wavelength and the beam waist diameter must be the same.

For example, the calculated divergence of a laser operating at a wavelength of 10.6 μ with a 7 mm beam waist diameter and an M^2 of 1.2 is as follows:

Θ = 4 x 0.0106 mm x 1.2 / (3.14 x 7) = 0.0023 rad = 2.3 mrad

Now calculate the beam diameter for the same laser as above at 2 meters from the beam waist:

D = $\sqrt{(49\ mm^2 + 0.0023^2 \times 2000\ mm^2)}$

D = $\sqrt{(49\ mm^2 + 5.29 \times 10^{-6} \times 4 \times 10^6\ mm^2)}$ = 8.4 mm

V.2 Focusing a Beam

Most laser processing applications call for focusing the laser beam to a small spot so that the high-power density can accomplish the desired work. This is true for applications involving cutting, drilling, scribing, welding, and others on a wide range of material. The typical question is what is the spot size that will be achieved for this application.

To achieve the smallest spot size, the beam must be focused with a lens that transmits the laser wavelength. To achieve the desired spot size, you must size the clear aperture for the diameter of the beam at that point using the guidelines covered in the section on beam diameters.

The approximate spot size of the focused laser beam using a lens with focal length *f* is:

$$D_f = \frac{4f\lambda M^2}{\pi D_e}$$

Where:

D_e is the beam diameter at the focusing lens

D_f is the focused beam diameter

To calculate for the same beam in the beam propagation example with a 5 inch (127 mm) focal length lens for a beam at 2 meters from the beam waist:

D_f = (4 x 127 mm x 0.0106 mm x 1.2)/(3.14 x 8.4 mm)

D_f = 0.245 mm = 245 µ

V.3 Rayleigh Range and Depth of Focus

When processing material, it is important to have knowledge of the work range where the process will function properly. The major issue is the acceptable range in the distance between a focusing lens and the work surface.

A convenient model for this is to calculate the Rayleigh range for the focused beam as an initial evaluation of the optical design.

The Rayleigh range is the difference in distance between the beam waist location and the point at which the beam is 1.4 times larger.

$$Z_r = \frac{\pi D_o^2}{4\lambda M^2}$$

The beam waist diameter can be for a focused beam in this issue, but it could also be any other beam waist and the equation would still be applicable.

For the same focused beam in the previous example, the Rayleigh range or depth of focus is:

Zr = (3.14 x(0.245 mm)2) / (4 x 0.0106 mm x 1.2)

Zr = (0.188 mm2) / (0.051 mm) = 3.7 mm

NOTE: Reducing the spot size also reduces the **depth of focus** more rapidly than the **spot size** is reduced. Thus, when reducing spot size, the process can become much more intolerant to variability in the distance between the focusing lens and the work piece.

The Rayleigh range provides a guide to the range of acceptable working distances, but the actual value depends on the process, the equipment, and dynamics between the two factors.

V.4 Beam Expansion

An increase in the beam diameter on a focusing lens can produce smaller focused spot size.

The other issue that beam expansion addresses is variation in the focused spot size on a gantry-based system. In these later systems, the beam size on the focusing lens varies as the distance between the laser and the focusing lens is moved. In turn, this causes the focused spot size to change as well as the distance to the beam waist.

Beam expansion reduces the change in the focused spot size and changes in focal point. The most simple beam expanders use two lenses with different focal lengths—see the example in Figure V-2.

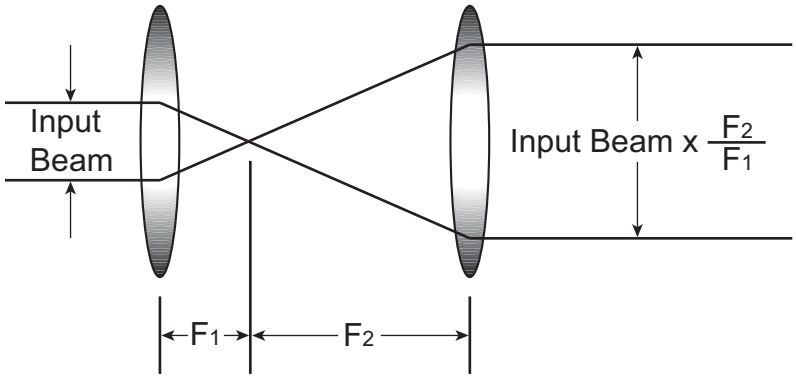


Figure V-2. Simple Beam Expander

The ratio of the focal lengths gives the magnification of the beam. Galilean beam expanders use a negative lens followed by a positive lens for expansion.

As an example, the simple beam expander in Figure V-3 shows the combination of a 2.5-inch and 5-inch lenses to magnify the beam by a factor of two.

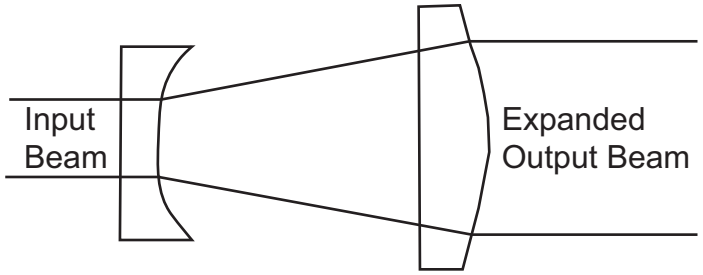


Figure V-3. Galilean Beam Expander

The proper separation of the two lenses is the sum of their focal lengths. Small adjustment of the separation is required to correct for the effect of the distance from the first lens to the beam waist.

On gantry-based systems, the beam expander can be used to adjust focus at the work surface.

This is accomplished by setting the final objective lens to exactly its back focal length (BFL) from the work surface (that is, along the middle of the optical axis). The BFL is specified by the lens manufacturer. Focusing is then done by adjusting the spacing of the lenses in the beam expander.

VI APPENDIX - METAMORPH DRIVER SET-UP

This appendix explains how to install and configure the OBIS MetaMorph (MM) driver for MetaMorph software.

VI.1 Supported Hardware

The OBIS MetaMorph driver currently supports the OBIS LG, OBIS LS, and OBIS LX lasers. These lasers can be connected directly into a PC or into an OBIS 1-Laser Remote (MINI), OBIS Scientific Remote (MASTER), or OBIS Laser Box (MULTI).

VI.2 Supported Operating Systems

- Windows XP (with Service Pack 3)
- Windows 7 (32- and 64-bit)
- Windows 8 (32- and 64-bit)

NOTICE

You must have Coherent MM Configuration and MetaMorph version 7.8.8.0 (or later) software installed on your computer.

VI.3 Coherent MM Configuration Program

Coherent product information and related software is now available in one easily accessible location on the Coherent website. Filter your search by product type, document category, or both. To download manuals and software, go to:

https://www.coherent.com/resources

1. To download the *OBIS MetaMorph Driver* zipped file to a PC, contact Coherent Technical Support as described in "Appendix - Service & Support" (p. 201) or go to the Coherent website.

   A message is displayed as the zipped file is downloaded.

2. Unzip the file to a directory that you select.

3. Double-click the OBIS MetaMorph Driver executable file (**`OBIS MetaMorph Driver v1.0.4.9_beta.exe`**) and follow on-screen directions to complete the installation.

VI.3.1 Install the Meta Imaging Series Software

First install the Meta Imaging Series Software before continuing with the installation of the OBIS MetaMorph driver.

VI.3.2 Set up the Coherent MM Configuration Program

To set up the program:

1. Go to this directory (depending on your system):
   `C:\Program Files (x86)\Coherent\OBIS MetaMorph Driver\Custom Driver\32-bit or 64-bit`

2. Replace the MM **`uic_d_CustomDriver.dll`** file with the file: **`uic_d_CustomDriver.dll`**

   Figure VI-1 shows an example the location of the original MM device driver file and the location of the Coherent MM device driver file (for a 64-bit system), which is used as the replacement file.

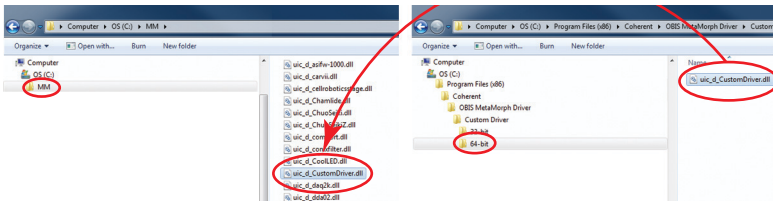


Figure VI-1. Location of the Device Driver Files

3. Connect all OBIS hardware to the PC (via USB or RS-232.

4. Turn power ON to the hardware.

5. Verify that the device just connected to the PC is listed in Device Manager, as shown in the example in Figure VI-2:

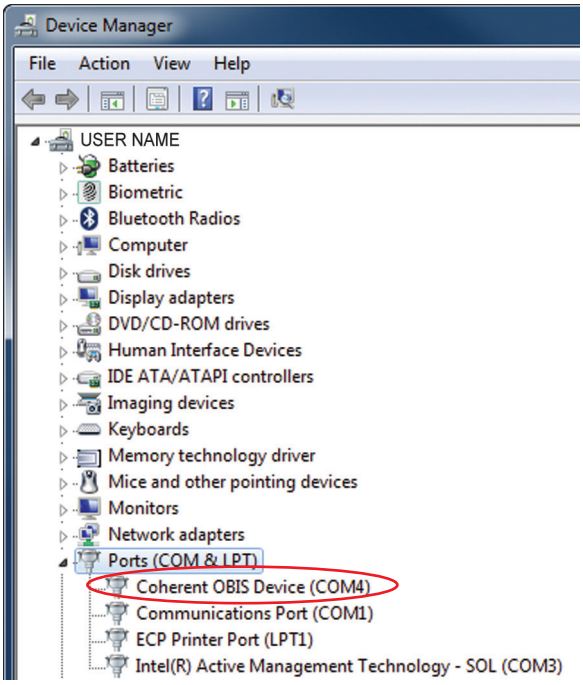


Figure VI-2. Verify Device Connected

6. Start the *Coherent MM Configuration* program by double-clicking the **Coherent MM Configuration.exe** file, shown in Figure VI-3:

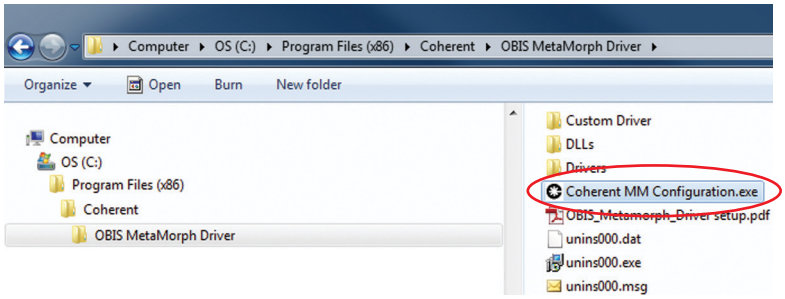


Figure VI-3. Start Configuration Program

NOTICE

You must run the Coherent MM Configuration program at least once to specify a laser; otherwise, the driver does not work.

7. Click Add, shown in Figure VI-4.

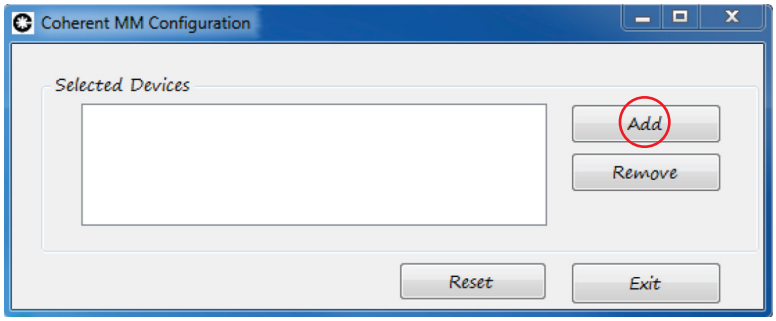


Figure VI-4. Add Button

8. Select a device from the drop-down menu (each device is identified by its type and serial number), and then click OK, shown in Figure VI-5.

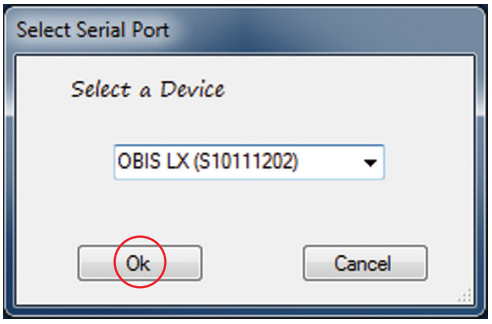


Figure VI-5. Select Device

9. Verify or edit settings for each laser connected to that device, and then click Save.

   ***NOTE:* You must save the parameters for a laser *before* selecting another laser or the changes will not be saved.**

The example in Figure VI-6 shows how the screen looks when two OBIS LX lasers are connected directly to the PC. The settings at the bottom of the screen are for the laser highlighted under **Selected Devices**.

An individual tab for each laser is listed under the **Set Default Settings** heading when you click a laser that is listed under **Selected Devices**. Each tab is identical and allows changing the associated parameters (**Power Level, Operating Mode,** and **5-Seconds CDRH Delay**).

After a laser is specified, run the Coherent MM Configuration program only if a parameter needs to be changed for that laser. The saved settings are applied every time the MetaMorph application starts running.

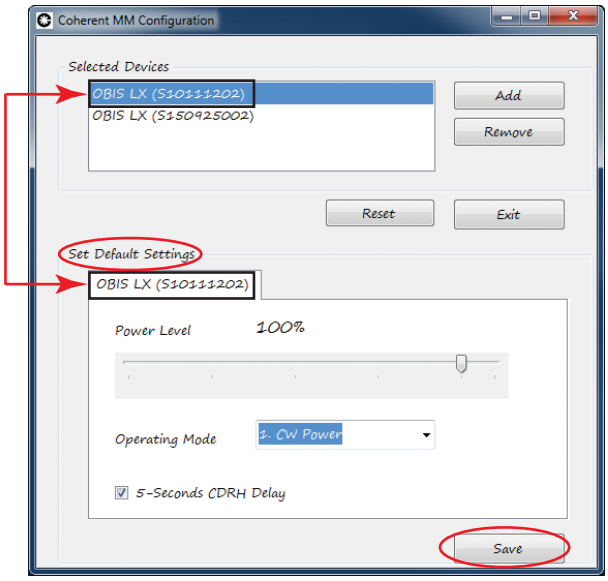


Figure VI-6. Two OBIS Lasers Connected

VI.3.2.1 Example

Following is an example of a typical operating procedure:

1. Connect an OBIS Laser—including communication and power cables—and then turn ON the laser.
2. Run the Coherent MM Configuration program to change settings (if needed) or if you need to add or remove an OBIS Laser.
3. Launch the **Meta Imaging Series Administrator** if:
   - There are changes in the Coherent MM Configuration program,
   - There has been a change in the order of OBIS hardware, or
   - There has been a change as to how a device is connected to the computer.
4. Launch the MetaMorph application.
5. When you are done, exit MetaMorph before disconnecting or powering-down the OBIS devices.

VI.3.3 Component Names

OBIS driver component names:

- A continuous component named **OBIS Laser type (*Serial Number*) Power Level**

- A shutter component named **OBIS Laser type (*Serial Number*) CDRH**
- A shutter component named OBIS Laser type (**Serial Number**) Emitting

Only lasers actually connected to the computer at start-up time are listed in the MetaMorph UI. If the arrangement of OBIS hardware changes between the time you run the **Meta Imaging Series Administrator** program to the time you start the MetaMorph application, some lasers might be labeled incorrectly. Rerunning the Meta Imaging Series Administrator program fixes the incorrect labeling.

This driver does not support "hot swapping."

- If you plug a laser to the remote after starting MetaMorph, it is not displayed in the user interface.
- If you unplug a laser after starting MetaMorph, it can result in an error.

VI.3.4 Operating Modes

The Coherent MM Configuration tool allows you to specify the operating mode for a laser. The operating mode must be specified once before using the DLL.

The Configuration tool allows you to select from the operating modes listed in the following tables. Note that Coherent MM Configuration presents different lists of choices, depending on the laser type and whether or not a controller is used.

Table VI-1 lists the operating modes for OBIS LX lasers ***with*** a controller:

Table VI-1. Coherent MM Configuration Tool – Operating Modes for LX Lasers (With Controller)

Operating Mode #	Per Config Program	OBIS LX Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP
2	CW Current	CW:Current	Continuous wave, fixed current level	CWC
3	Digital Modulation	Digital:Current	Digital modulation	DIGITAL
4	Digital Power	Digital:Power	External digital modulation with power feedback	DIGSO
5	Analog Modulation	Analog:Power	Analog modulation	ANALOG

Table VI-1. Coherent MM Configuration Tool – Operating Modes for LX Lasers (With Controller)

Operating Mode #	Per Config Program	OBIS LX Lasers	Description	SCPI
6	Mixed Power	Mixed:Power	Alternative mixed modulation	MIXSO
7	Mixed Modulation	Mixed:Current	Mixed analog and digital modulation	MIXED

Table VI-2 lists the operating modes for OBIS LS lasers ***with*** a controller:

Table VI-2. Coherent MM Configuration Tool – Operating Modes for LS Lasers (With Controller)

Operating Mode #	Per Config Program	OBIS LS Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP
2	Digital Current	Digital Modulation	Alternative mixed modulation	DIGITAL
3	Analog Power	Analog Modulation	Analog modulation	ANALOG
4	Mixed Current	Mixed Modulation	Mixed analog and digital modulation	MIXED

Table VI-3 lists the operating modes for OBIS LG lasers ***with*** a controller:

Table VI-3. Coherent MM Configuration Tool – Operating Modes for LG Lasers (With Controller)

Operating Mode #	Per Config Program	OBIS LG Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP
2	CW Current	CW:Current	Continuous wave, fixed current level	CWC
3	Digital Modulation	Digital:Power	External digital modulation	DIGSO

Table VI-4 lists the operating modes for OBIS LX lasers with NO controller:

Table VI-4. Coherent MM Configuration Tool Operating Modes - LX Lasers (With NO Controller)

Operating Mode #	Per Config Program	OBIS LX Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP
2	CW Current	CW:Current	Continuous wave, fixed current level	CWC

Table VI-5 lists the operating modes for OBIS LS lasers with NO controller:

Table VI-5. Coherent MM Configuration Tool Operating Modes - LS Lasers (With NO Controller)

Operating Mode #	Per Config Program	OBIS LS Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP

Table VI-6 lists the operating modes for OBIS LG lasers with NO controller:

Table VI-6. Coherent MM Configuration Tool Operating Modes - LG Lasers (With NO Controller)

Operating Mode #	Per Config Program	OBIS LG Lasers	Description	SCPI
1	CW Power	CW:Power	Continuous wave, fixed power level	CWP
2	CW Current	CW:Current	Continuous wave, fixed current level	CWC

VI.4 Configure OBIS_MetaMorph.dll to MetaMorph

After successfully completing the following procedure, MetaMorph will be ready to use the custom driver.

1. Connect all OBIS hardware, via USB or RS-232, to your computer.
2. Start the Meta Imaging Series Administrator by double-clicking the **`mmadmin.exe`** file, shown in Figure VI-7:

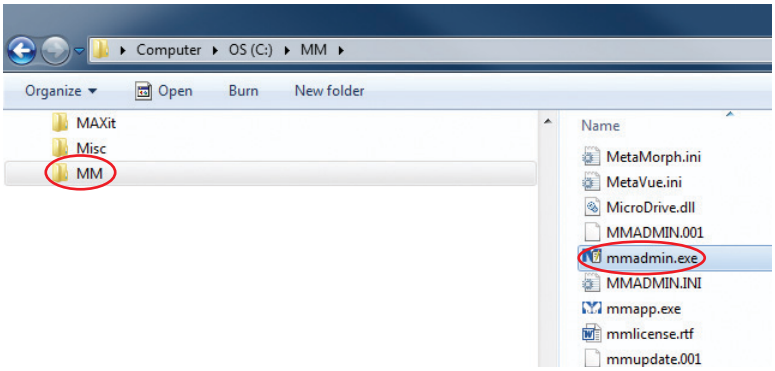


Figure VI-7. Run the .exe File

3. Click the Configure Hardware button, shown in Figure VI-8.

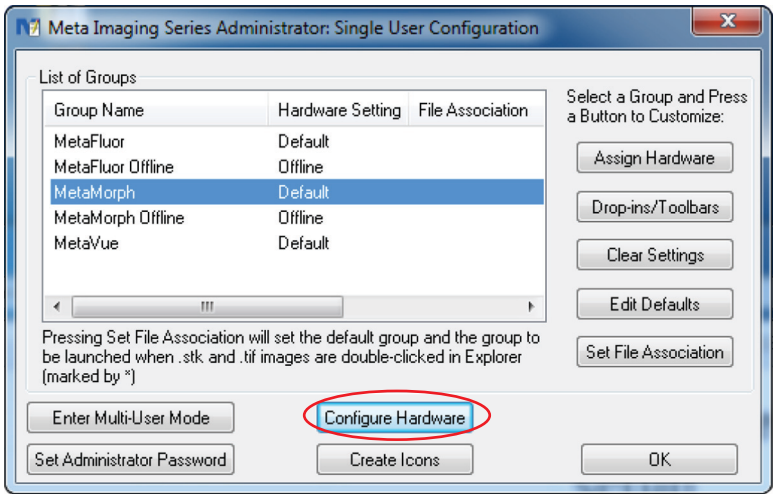


Figure VI-8. Configure Hardware Button

4. As shown in Figure VI-9, select the desired setting or create a new one, and then click the Install System Devices button.

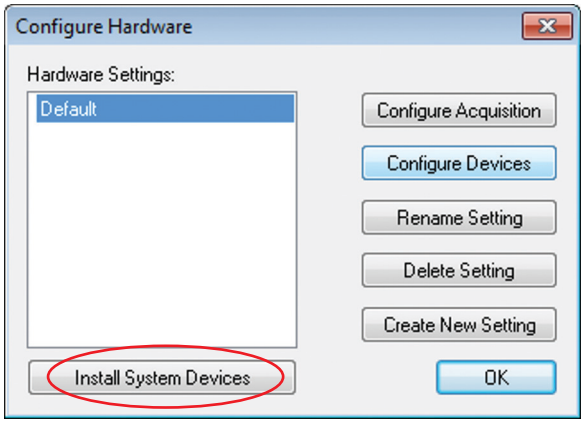


Figure VI-9. Install System Devices

5. Select **Custom Driver** from the left side panel, as shown in Figure VI-10, and then click the Install button.

NOTICE

You must always remove any earlier versions of old drivers and start with a clean "Custom Driver". If you reuse an earlier "Custom Driver," the program might incorrectly label the lasers.

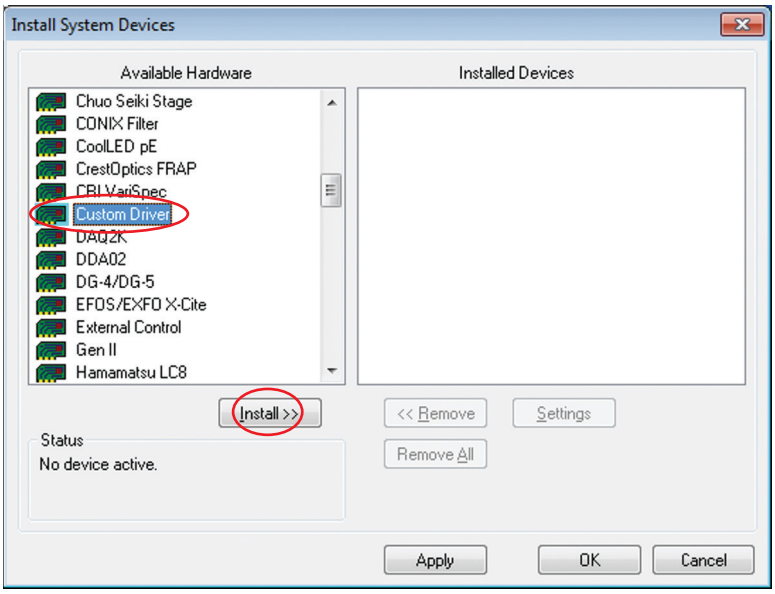


Figure VI-10. Install Custom Driver

6. When the error message shown in Figure VI-11 is displayed, click OK.

Figure VI-11. Error Message

7. Click the directory for **Custom Driver** in the right column, and then click Settings, as shown in Figure VI-12.

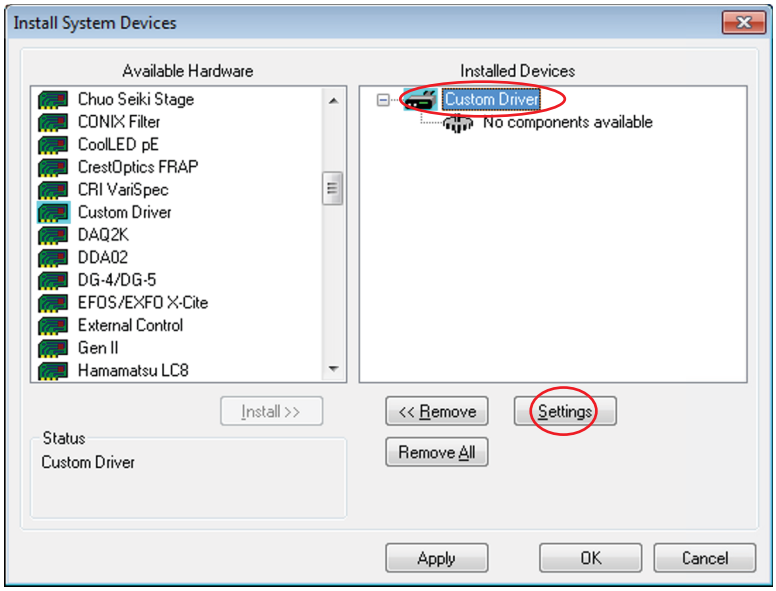


Figure VI-12. Apply Settings to the Custom Driver

8. Click the Browse for DLL file button, as shown in Figure VI-13.
   - Use a 32-bit DLL (. . .**\Win32\OBIS_MetaMorph.dll**) if you are running a 32-bit machine.
   - Use a 64-bit DLL (. . .**\Win64\OBIS_MetaMorph.dll**) if you are running a 64-bit machine.

   The DLL file path must point to wherever the **OBIS_MetaMorph.dll** file is located.
9. After the DLL file path is entered, click OK.

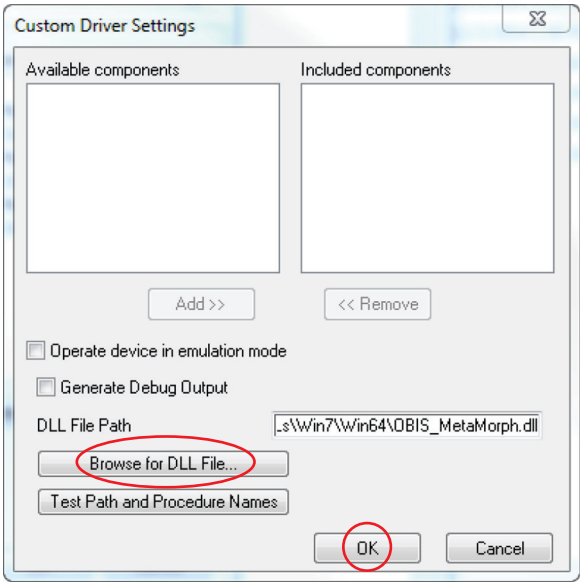


Figure VI-13. Browse for DLL File

By default, the installer saves the DLL this directory:

`C:\Program Files (x86)\Coherent\OBIS MetaMorph Driver\DLLs\Win7\Win64\OBIS_MetaMorph.dll`

10. In the window shown in Figure VI-14, click Apply and then OK.

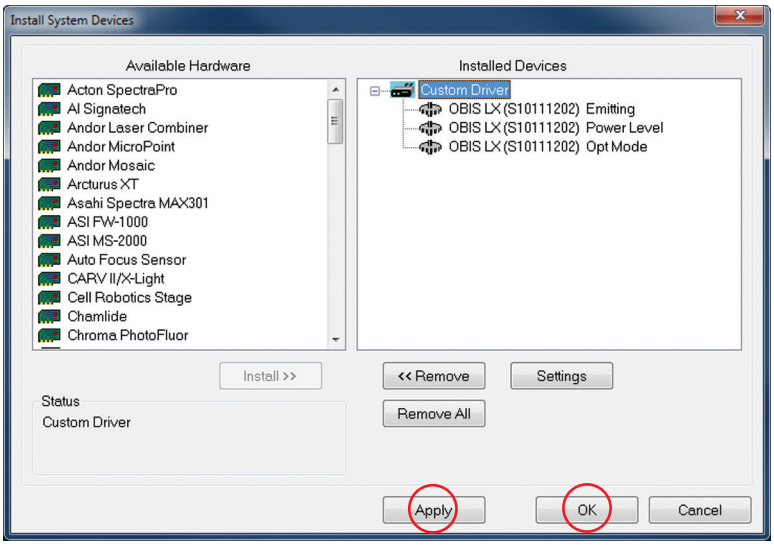


Figure VI-14. Apply Custom Driver

11. In Configure Hardware (Figure VI-15), click Configure Devices.

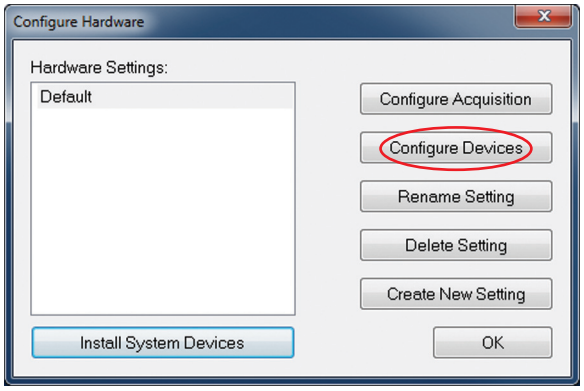


Figure VI-15. Configure Devices

12. Select the directory for Custom Driver from the left table, and click Add to include the component, as shown in Figure VI-16.

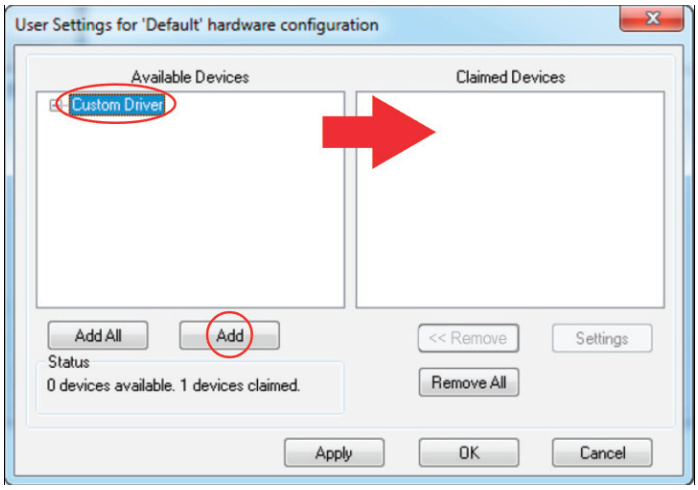


Figure VI-16. Add Custom Driver to Devices

13. Click Apply, then OK to save these settings, as shown in Figure VI-17.
14. Click OK again to close the Configure Hardware window, shown in Figure VI-18.

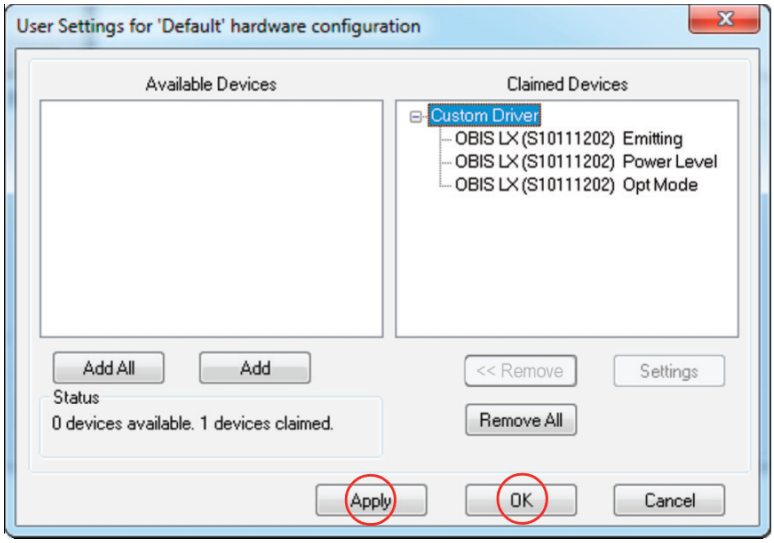


Figure VI-17. Save Settings

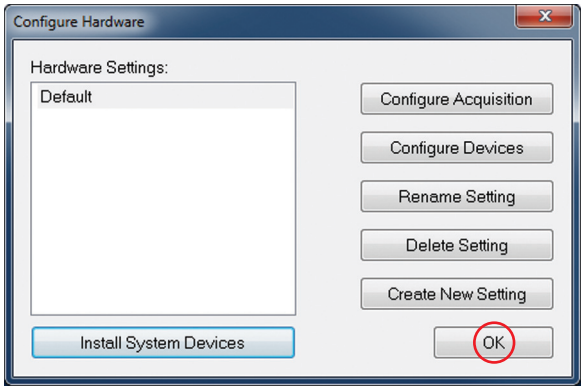


Figure VI-18. Close Configure Hardware Window

15. Click OK to close the Meta Imaging Series Administrator program, shown in Figure VI-19.

NOTICE

You must go through these steps each time you make changes in the configuration program, rearrange the order of OBIS hardware, or change how a device connects to the computer.

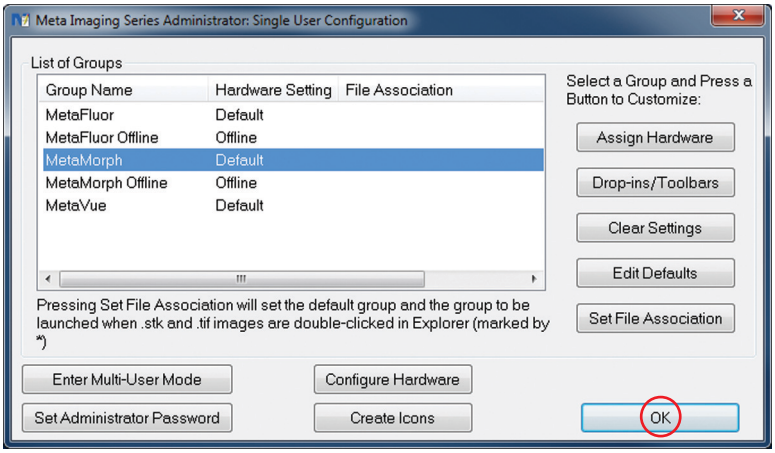


Figure VI-19. Close the Program

VI.5 Run MetaMorph

To run MetaMorph:

1. Click the MS Windows **Start** button and select **All Programs**.
2. Click **Meta Imaging Series 7.8**, and then click **MetaMorph**, as shown in Figure VI-20.
3. From the Devices drop-down menu, select ‘Configure Illumination’ as shown in Figure VI-21.

The window shown in Figure VI-22 is displayed:

- Use the ‘Power Level’ combo box to adjust the power level in full-integer percentages (0 to 110%).
- ‘Opt Mode’ displays the operating mode as configured with the *Coherent MetaMorph Configuration* program—refer to “Operating Modes” (p. 174).
- “Emitting” displays the current emission state of the laser.

4. Adjust the parameters (as needed), and click the Add / Replace button shown in Figure VI-23 to define the new settings.
5. Click the Close button shown in Figure VI-24 to exit the Configure Illumination window.

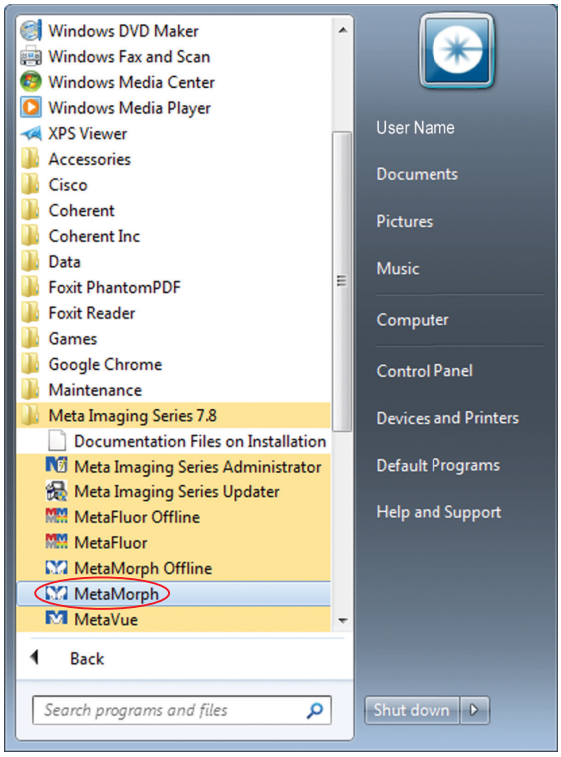


Figure VI-20. Run MetaMorph in the Windows Start Panel

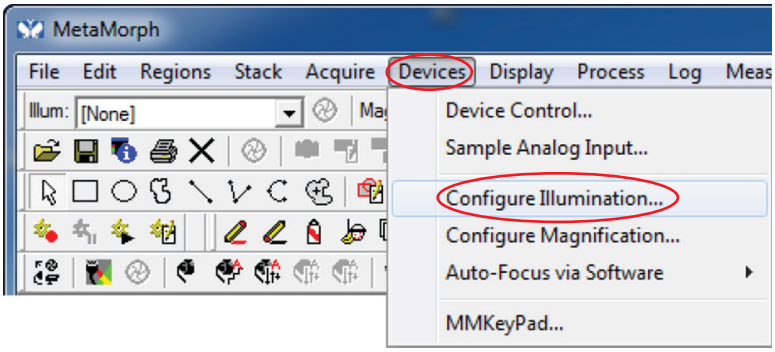


Figure VI-21. Configure Illumination Menu Option

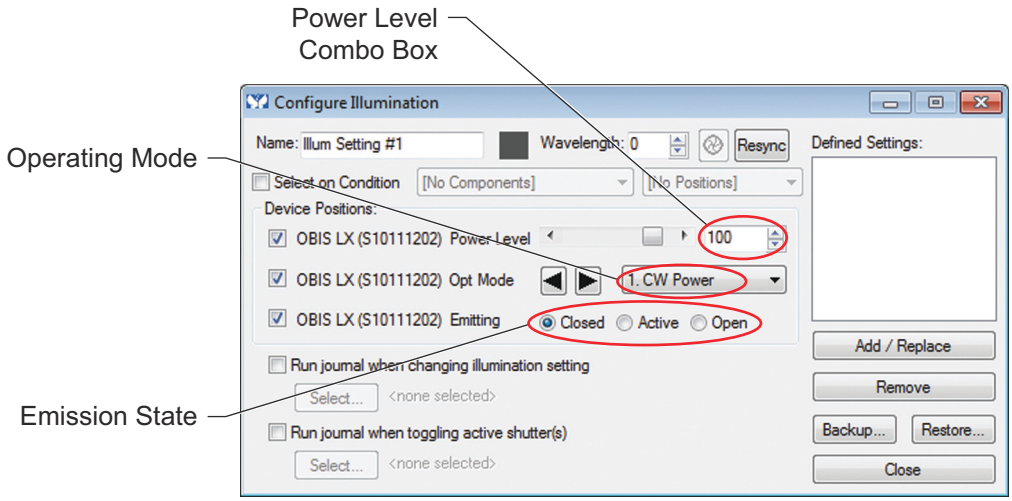


Figure VI-22. Settings for Configure Illumination

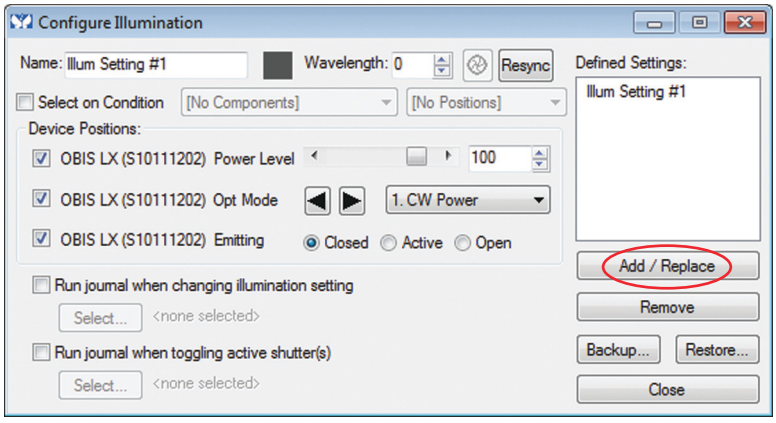


Figure VI-23. Define New Settings

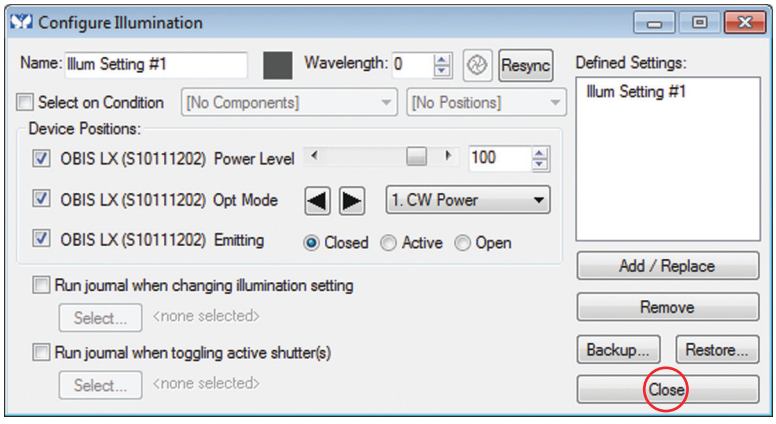


Figure VI-24. Close Configure Illumination Settings

6. Click the "X" to separately close the MetaMorph program, as shown in Figure VI-25.

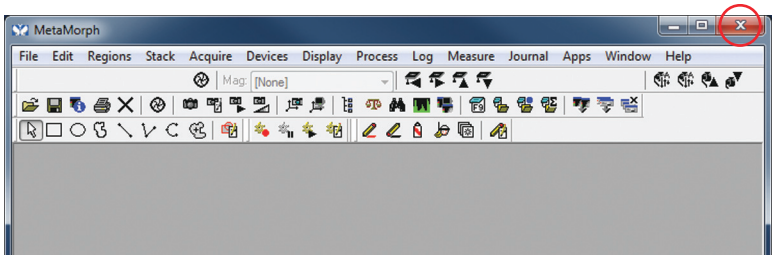


Figure VI-25. Close the MetaMorph Program

VI.6 MetaMorph Technical Support

Additional product technical support is available by calling Molecular Devices, LLC at 1.800.635.5577 x1820 or the following sites:

Online support:
http://support.metamorph.com

Installation instructions:
http://mdc.custhelp.com/app/answers/detail/a_id/19276

Software updates:
http://www.meta.moleculardevices.com/software/mm/updates/

VI.7 Micro-Manager

The latest driver available for OBIS LS/LX can be found at:

https://micro-manager.org/wiki/CoherentOBIS

For additional information, contact Coherent Product Support—see "Appendix - Service & Support" (p. 201) for methods of contact.

VII APPENDIX - POWER MEASUREMENT RECOMMENDATIONS

Coherent offers a wide variety of instruments for laser test and measurement.

For the most common diagnostics need—measuring the output power of the OBIS—Coherent recommends two different types of power meters that are ideal fits to the OBIS product family.

Coherent product information and related software is now available in one easily accessible location on the Coherent website. For detailed information about these products, contact your Coherent sales representative or visit:

https://www.coherent.com/resources

VII.1 First Recommendation

Coherent offers a product combination that covers that entire wavelength range at these power levels.

The PS10, shown in Figure VII-1, is a thermally-stabilized, amplified thermopile power sensor with a broad spectral response, high sensitivity, and a large active area. It is designed for measurements in the 100 µW to 1 W region.

PS10 High-Sensitive Thermopile Sensor (RoHS), P/N 1098350

FC Fiber Optic Connector Adapter, P/N 0012-3863

Figure VII-1. Power Measurement: PS10 Sensor and Adapter

Coherent recommends the FieldMaxII-TOP, shown in Figure VII-2, to work with the PS10 sensor.

FieldMaxII-TOP Laser Power and Energy Meter (RoHS), P/N 1098580

Figure VII-2. Power Measurement: FieldMax–II

The FieldMaxII—an affordable, versatile, easy-to-use digital meter—is designed for field service and production applications. This meter features an easy-to-read liquid crystal display (LCD) with a back light and direct button-driven commands for simple, no-hassle use.

VII.2 Additional Recommended Products

LaserCheck is a hand-held, inexpensive laser power meter designed to supply power measurements in a small, lightweight, self-contained package. This device, shown in Figure VII-3, can easily be stored in a pocket or tool kit.

With its compact size, LaserCheck enables measurements at places in optical set-ups where a standard detector cannot fit. With its built-in attenuator, this device is prepared to measure output power from 0.5 μW to 1 W.

LaserCheck Hand-held Power Meter (RoHS), P/N 1098293

Figure VII-3. Power Measurement: LaserCheck

NOTICE

LaserCheck does not measure below 400 nm, so this device is not recommended for the OBIS 375 laser.

VII.3 OBIS Galaxy Power Meter Accessory

The PowerMax-USB UV/VIS Quantum Power Sensor incorporates a Silicon photodiode for measurement of power from 5 µW to several hundred milliwatts.

A spectrally-calibrated ND2 filter is used to attenuate the laser beam, thus allowing for a higher average power measurement than is typically possible with a photodiode.

Figure VII-4 shows the PowerMax-USB Quantum Power Sensor.

PowerMax-USB UV/VIS Quantum Power Sensor (RoHS), P/N 1168337

Figure VII-4. Power Measurement: PowerMAX–USB

The sensor works with Continuous Wave (CW) as well as pulsed sources greater than 100 pulses per second (PPS).

The removable nose cone can be used to reduce stray light, which is helpful when measuring on the low end of the power range.

VIII APPENDIX - LASER REPACKING PROCEDURE

This section describes the factory-recommended repacking procedure for both the OBIS Laser System and OBIS FP Laser System. The applicable procedure must be followed if the laser system is shipped to another location after initial installation or returned to the factory for service.

NOTICE

Coherent recommends that the shipping box and packing materials be saved after initial purchase. These packing materials are required if the laser needs to be shipped elsewhere or returned to Coherent.

If you have any questions, contact your Coherent as follows:

- Call the Technical Support Hotline at +**1-(734) 456-3100**
- Send an e-mail to: customer.support@coherent.com
- Contact your local Coherent service representative (see www.Coherent.com/support/ for worldwide contacts)

When communicating with the Technical Support Department either via the web or telephone, the Support Engineer responding to your request requires the Coherent part number and the product serial number.

VIII.1 Components Shipped

Table VIII-1 lists the components sent with the different OBIS Laser System configurations.

Table VIII-1. Components Shipped

Item Description	Included with							
	Laser	Laser System	OBIS Remote	OBIS 6-Laser	OBIS Scientific Remote	OBIS Laser Box	OBIS Galaxy	Spare Parts Accessory Bag
OBIS Laser	X	X						
Laser mounting bolts/ washers (4 each)	X	X						
OBIS Remote		X	X					
OBIS 6-Laser Remote				X				
OBIS Scientific Remote					X			
OBIS Laser Box						X		
OBIS Galaxy							X	
Laser Safety and Software Installation Guide	X	X	X		X			X
Keys for OBIS Remote (2 each)		X	X	X	X	X		X
Interlock, shorted, for OBIS Remote		X	X	X	X	X		X
Wavelength labels for OBIS Remote		X	X	X	X			X
Mounting brackets/hardware for OBIS Remote		X	X	X		X		
Cable, SDR, laser to OBIS Remote (1 meter)		X			X[a]			
USB cable, Type A to Type Mini-B (1.8 meters)		X	X			X		
Power supply, 110/220V AC, 12V DC, IEC-320		X	X	X		X		
Power cord, USA to IEC-320		X	X	X		X		

Table VIII-1. Components Shipped (Continued)

Item Description	Included with							
	Laser	Laser System	OBIS Remote	OBIS 6-Laser	OBIS Scientific Remote	OBIS Laser Box	OBIS Galaxy	Spare Parts Accessory Bag
Cable, 8-pin, I/O for OBIS Remote (1 meter)								X
Cable, 2-pin, power for OBIS 6-Laser Remote (1 meter)				X[a]				X
Heatsink, with fan/hardware	Order separately.							
Laser emission indicator with interlock connector	Order separately.							
Cable, SDR, laser to OBIS Remote (0.3m or 3m versions available)	Order separately.							

a. Includes six 1-meter cables.

VIII.2 OBIS Repacking Procedure

When using the following procedure, refer to Figure VIII-1 to correctly position all components in the shipping box.

To repack the OBIS laser system:

1. Put the laser in the silver ESD bag and place the ESD bag inside the ESD box.
2. Place the ESD foam top over the ESD bag, close the box and secure the box with tape.
3. Put the ESD box in the lower right compartment of the shipping box.
4. Place the OBIS Remote (if present) in the ESD pink poly bag and then position the bag in the upper right compartment of the shipping box.
5. Put the power supply (if present) in the white box and then position the box in the left compartment of the shipping box.
6. Place all other system components in the ESD pink poly bag and then position the bag in the left compartment of the shipping box.

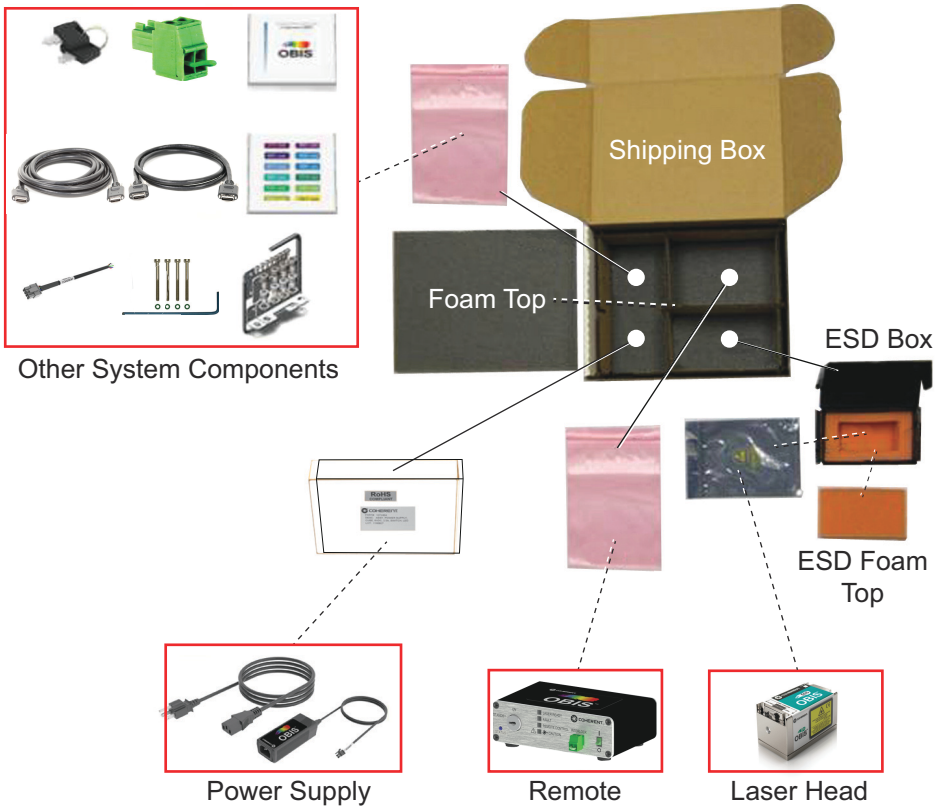


Figure VIII-1. OBIS Shipping Container Showing Component Placement

7. Position the foam top in the shipping box, close the shipping box, and secure the box with tape.

If you are returning the system to Coherent for service:

- Contact Coherent Customer Service at **+1-(734) 456-3100** to request an RMA number.
- Write the RMA number on the shipping label.

VIII.3 OBIS LX FP Repacking Procedure

When using the following procedure, refer to Figure VIII-2 to correctly position all components in the shipping box.

NOTICE
DO NOT touch the laser fiber output!
Always use Nitrile gloves whenever you handle the fiber output.

Remember to maintain ESD precautions at all times.

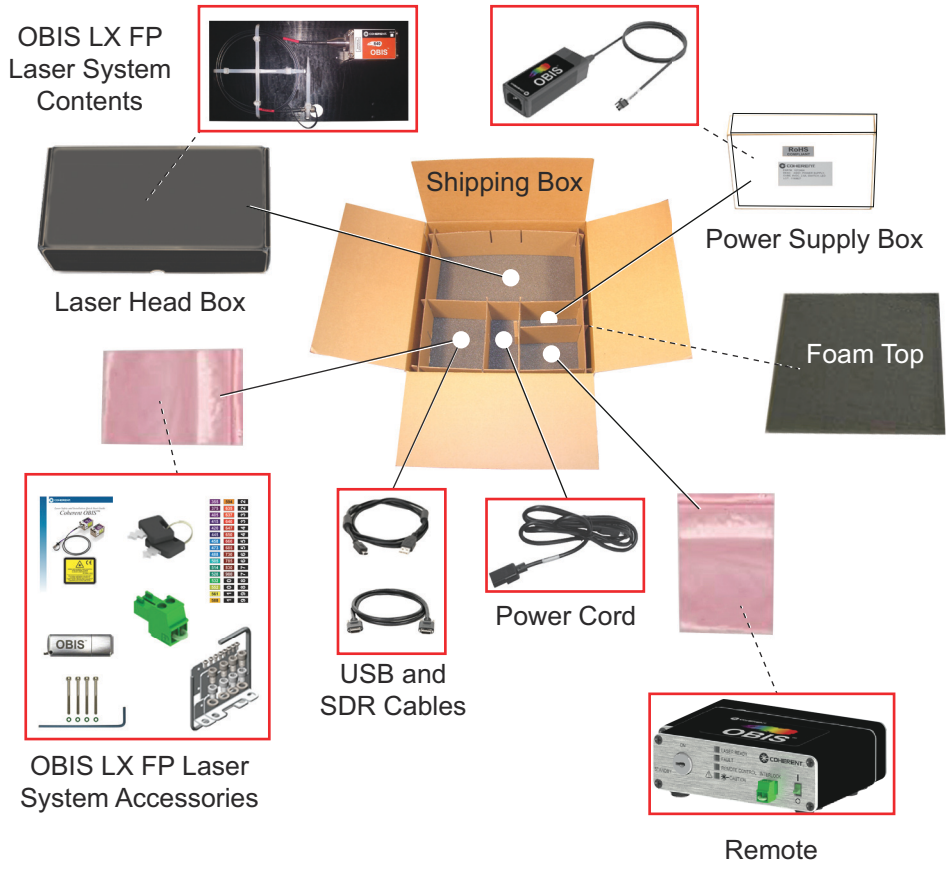


Figure VIII-2. OBIS LX FP Shipping Container Showing Component Placement

To repack the OBIS LX FP laser system:

1. Secure the OBIS LX Laser to the mounting plate using the four M3 x 35 mm screws and washers. Carefully coil the fiber into a circle and fasten with the five re-sealing zip ties (refer to the Figure VIII-3).
2. Put the secured laser in the black laser box, close the box and secure the box with tape.
3. Place the laser box in the top compartment of the shipping box.
4. Place the OBIS Remote (if present) in the ESD pink poly bag and then position the bag in the lower right compartment of the shipping box.
5. Place the power supply (if present) in the white power supply box and then position the box in the right middle compartment of the shipping box.
6. Place all other system components in the ESD pink poly bag and then position the bag in the lower left compartment of the shipping box.

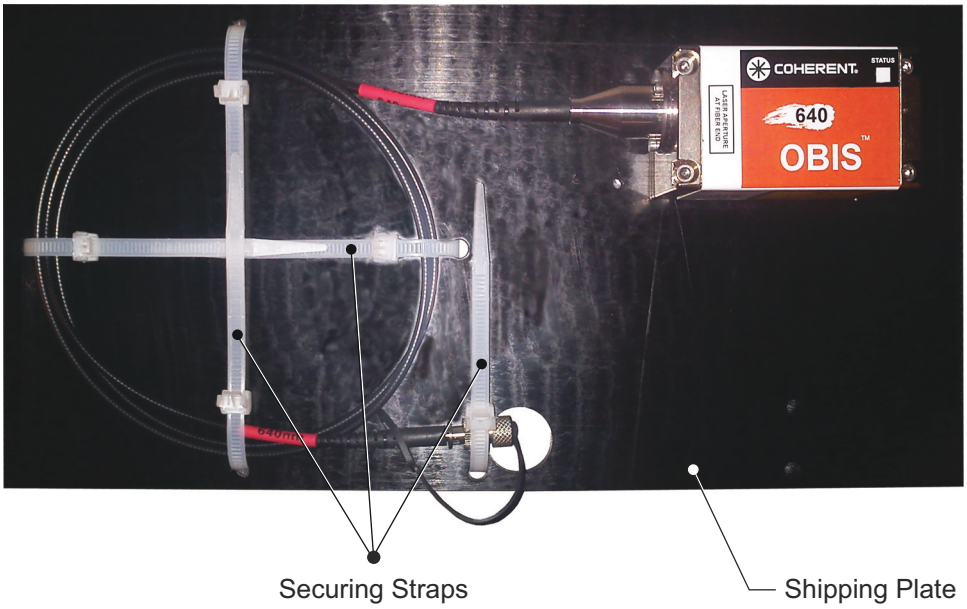


Figure VIII-3. OBIS FP Laser Secured to the Shipping Plate

7. Position the foam top in the shipping box, close the shipping box and secure the box with tape.

If you are returning the system to Coherent for service:

- Obtain an RMA number by calling Technical Support at **+1-(734) 456-3100**
- Include the RMA number on the shipping label.

VIII.4 OBIS LS FP Repacking Procedure

Repacking an OBIS LS FP laser requires special handling.

NOTICE
DO NOT touch the laser fiber output!
Use Nitrile gloves whenever the fiber output is handled.

Remember to maintain ESD precautions at all times.

The OBIS LS FP packaging box provides space only for the OBIS LS FP itself. You must pack accessories—for example the OBIS Remote, the power cord, and the power supply—in the separate packaging box.

1. Check that the fiber tip of the OBIS LS FP is protected by the shutter cap, as shown in Figure VIII-4.

Shutter Cap (closed)

Figure VIII-4. OBIS LS FP Fiber Tip with Shutter Cap in Closed Position

2. Open the lid of the OBIS LS Laser Fiber-coupled Packaging Set (Coherent P/N 1256148).

Figure VIII-5. OBIS LS Laser Fiber-coupled Packaging Set

3. Take out the small foam insert and keep it for use in Step 6 of this procedure.

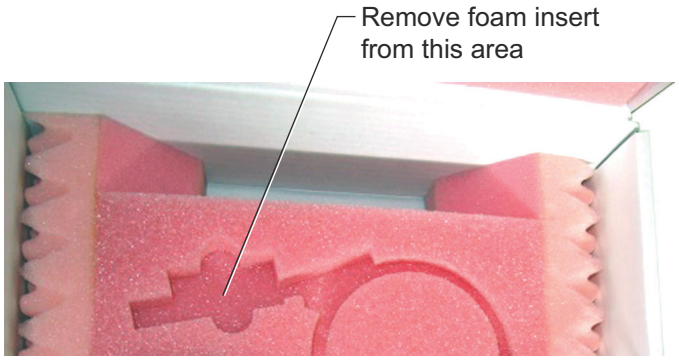


Figure VIII-6. Packaging with Foam Insert Removed

CAUTION!
DO NOT bend the fiber!

4. Carefully position the laser and wind the fiber as shown in Figure VIII-7. Make sure the fiber end is set in the designated space in the packaging foam.

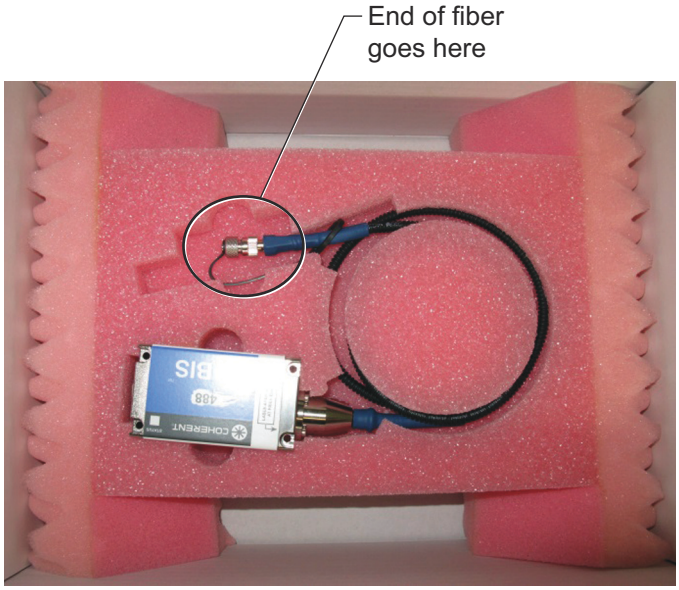


Figure VIII-7. Fiber Positioned in Packaging Foam

5. Place the small foam insert (removed in Step 3, above) over the fiber end to secure it for shipping, as shown in Figure VIII-8.

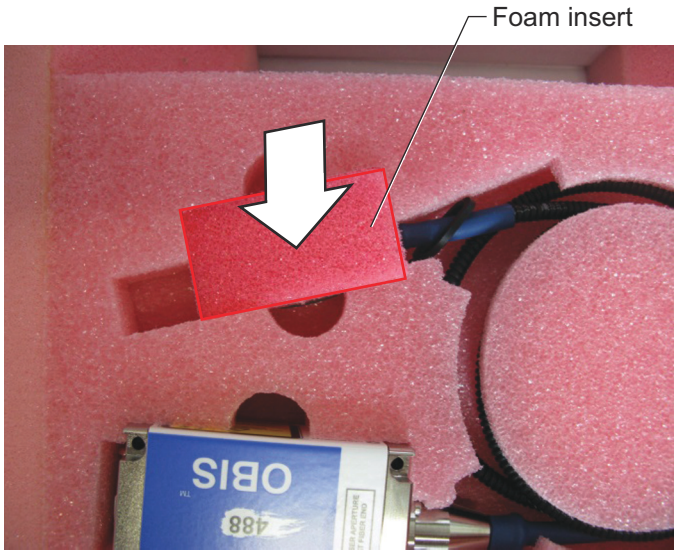


Figure VIII-8. Fiber End Secured in Packaging Foam

6. Place the cover packaging foam, cone side facing down, onto the OBIS LS FP in the cover foam as shown in Figure VIII-9.
   - Make sure the knobs direct towards the OBIS LS FP.
   - Put the screw set and the *Quick Start Guide* on top of the flat side of the cover foam.

Figure VIII-9. Cover Foam in Place in the Shipping Box

7. Close the shipping box and secure the box with tape, as shown in Figure VIII-10.

Figure VIII-10. OBIS LS Laser Fiber-coupled Packaging Set

If you are returning the system to Coherent for service:

- Contact Coherent Customer Service at +**1-(734) 456-3100** to request an RMA number.
- Write the RMA number on the shipping label.

See "Appendix - Service & Support" (p. 201) for more details.

IX APPENDIX - SERVICE & SUPPORT

This section provides information about:

IX.1 Technical Support

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.

Operation of any Coherent laser with any of its interlocks (or safety features) defeated is always at the operator's own risk. Under no circumstances do these support services affect the terms of any Warranty agreement between Coherent and the buyer.

Be prepared to provide the following information to the Product Support Engineer responding to your request:

- Model or part number of your unit
- Laser head serial number
- A description of the problem
- Any corrective steps you may have attempted

IX.1.1 Support in the USA and North America

Should you experience any difficulties with your laser or need product or technical information, contact Coherent Technical Support as follows:

- By email: customer.support@coherent.com
- Visit our website: www.Coherent.com
- By phone: **+1 (734) 456-3100**

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 calls will be quickly returned the next business day.

IX.1.2 International Support

If you are located outside the U.S., visit www.Coherent.com for technical assistance, or contact your local Service Representative directly:

- Germany: +49–6071–968–0
- Japan: +813–5635–8680

On the Coherent website, you can also view contact information (telephone numbers and addresses) for Service Representatives worldwide.

IX.2 Obtain Service

To obtain service under this warranty, Customer must notify the Company of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service.

The Company shall, in its sole discretion, determine whether to perform warranty service at the Customer's facility, at the Company's facility, or at an authorized repair station.

If Customer is directed by the Company to ship the product to the Company or a repair station, Customer shall:

- Package the product (to protect from damage during shipping) as instructed in "Product Shipping Instructions" next.
- Ship it to the address specified by the Company, with shipping prepaid. back to Coherent in conjunction with recalibration and recertification.
- Coherent shall pay the cost of shipping the Product back to the Customer in conjunction with product failures within the first twelve (12) months of time of sale or during an extended 12-month warranty period.

IX.3 Product Shipping Instructions

Refer to section "Appendix - Laser Repacking Procedure" (p. 191) for instructions about factory-recommended repacking of OBIS laser systems.

You must include a Returned Material Authorization number (RMA) assigned by the Company on the outside of all shipping packages and containers. Items returned without an RMA number are subject to return to the sender. Detailed instructions to prepare a product for shipping are provided in the next section.

To prepare a product for shipping to Coherent:

1. Contact Customer Service for a Return Material Authorization number.
2. Attach a tag to the product that includes the name and address of the owner, the person to contact, the serial number, and the RMA number you received from Coherent Customer Service. Pack this tag inside the box.
3. Wrap the product with polyethylene sheeting or equivalent material.
4. Using the original shipping and packaging materials, pack the product.
5. Seal the shipping carton with shipping tape or an industrial stapler.
6. Write the RMA number on the shipping label on the outside of the box.
7. Ship the product to the following address:

   Coherent, Inc.
   Attn: RMA #
   27650 SW 95th Ave.
   Wilsonville, OR 97070 USA

X APPENDIX - WARRANTY

Coherent, Inc. warrants OBIS Laser Systems to the original purchaser (the Buyer) only; that the laser system that is the subject of this sale, (a) conforms to Coherent's published specifications, and (b) is free from defects in materials and workmanship.

Laser systems are warranted to conform to Coherent's published specifications and to be free from defects in materials and workmanship for a period of twelve (12) months. Replacement units shipped within warranty, carry the remainder warranty of the failed unit.

X.1 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 laser 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.

X.2 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

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.

GLOSSARY

°C	Degrees Centigrade or Celsius
°F	Degrees Fahrenheit
Ω	Ohm(s)
μ	Micron(s)
μm	Micrometer(s) = 10^{-6} meters
μrad	Microradian(s) = 10^{-6} radians
μsec	Microsecond(s) = 10^{-6} seconds
$1/e^2$	Beam diameter parameter = 0.13534

AC	Alternating current
Address	A unique one-byte identifier assigned to each device on the bus
Amp	Ampere(s)
APC	Angle physical contact
Application Protocol	A set of application defined commands and replies used to implement a system of cooperative devices
Automatic Send Data Control	An optional hardware feature that is useful to control enable/disable of transmit enable line of RS-485 transceiver

BNC	Type of connector
Broadcast Message	Message sent by a master device and received by all connected slave devices
BUSMGMT	Message is a bus management message

CCB	Coherent Connection Bus, a RS-485 communication bus
CDRH	Center for Devices and Radiological Health
cm	Centimeter(s)
CW	Continuous wave

DC	Direct current
DDL	Direct diode laser
Destination Address	Address of the recipient device for a message
DHCP	Dynamic Host Configuration Protocol. A protocol that provides a means to dynamically allocate IP addresses to computers on a local area network.
DLE	Data link escape

EOM	A two-byte sequence indicating the end of a message packet
ESD	Electrostatic discharge
ETX	End of message data

FC	Fiber-connector
FP	Fiber pigtail

g	Gram(s) or earth's gravitational force (gravity)
GUI	Graphical user interface
HeNe	Helium neon
Hz	Hertz or cycles per second (frequency) (= 1/ pulse period)
IEC	International Electrotechnical Commission
IR	Infrared (wavelength)
I/O	Input/output
kg	Kilogram(s) = 10^3 grams
kHz	Kilohertz = 10^3 hertz
kOhm	Kilohm(s) = 10^3 ohms
LCD	Liquid crystal display
LED	Light emitting diode
LS version	OBIS Laser, based on optically pumped semiconductor laser (OPSL) technology
LX version	OBIS Laser, based on direct diode laser (DDL) technology
m	Meter(s) (length)
mA	Milliamp(s) = 10^{-3} Amperes
mAmp	Milliampere(s)
Master	Controlling device which manages bus direction, assigns device addresses, and generally the source for all application protocol command initiation
MHz	Megahertz = 10^6 hertz
mm	Millimeter(s) = 10^{-3} meters
mrad	Milliradian(s) = 10^{-3} radians (angle)
ms	Millisecond(s) = 10^{-3} seconds
mV	Millivolt(s)
MVP	Modulation and variable power
mW	Milliwatt(s) = 10^{-3} Watts (power)
NA	Numerical aperture
nm	Nanometer(s) = 10^{-9} meters (wavelength)
N·m	Newton meter
OBIS Remote	A dedicated Coherent device that serves as a communication gateway to a single laser and provides a CDRH-compliant keyswitch and interlock capabilities.
OEM	Original equipment manufacturer
OPSL	Optically-pumped semiconductor laser
oz·in.	Ounce inches
PIP	Port Identification Pin, a signal pin located on the cable connecting the slave device to the CCB
PPS	Pulses per second
rms	Root mean square (effective value of a sinusoidal wave)
RMA	Return material authorization
SCPI	Standard commands for programmable instruments. This standard, developed by Hewlett-Packard, complements IEEE 488 and is promoted by the SCPI Consortium.
SDR	Shrunk delta ribbon. This connector type is used on the back panel of the OBIS Laser for the full-feature I/O cable.
Slave	Device which receives and interprets messages and responds as required
SOM	A two-byte sequence indicating the start of a message packet
Source Address	Address of the device transmitting a message

Standard Message
: Message sent from the master device to a specific slave device address

SRCCCB
: Message originated from CCB stack

SRCCONT
: Message originated from master device (controller)

STX
: Start of message data

System Protocol
: A set of predefined bus management commands and responses used by CCB protocol stacks for set-up and management of the bus

TEC
: Thermoelectric cooler

TEM
: Transverse electromagnetic mode (cross-sectional laser beam mode)

TTL
: Transistor-transistor logic

UART
: Universal asynchronous receiver/transmitter

UFC
: Ultra-flat contact

UV
: Ultraviolet

V
: Volt(s)

VAC
: Volts, alternating current

VDC
: Volts, direct current

W
: Watt(s) (power)

INDEX

OBIS LX/LS Lasers Operator's Manual - Part 1 of 3 Description & Operation

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