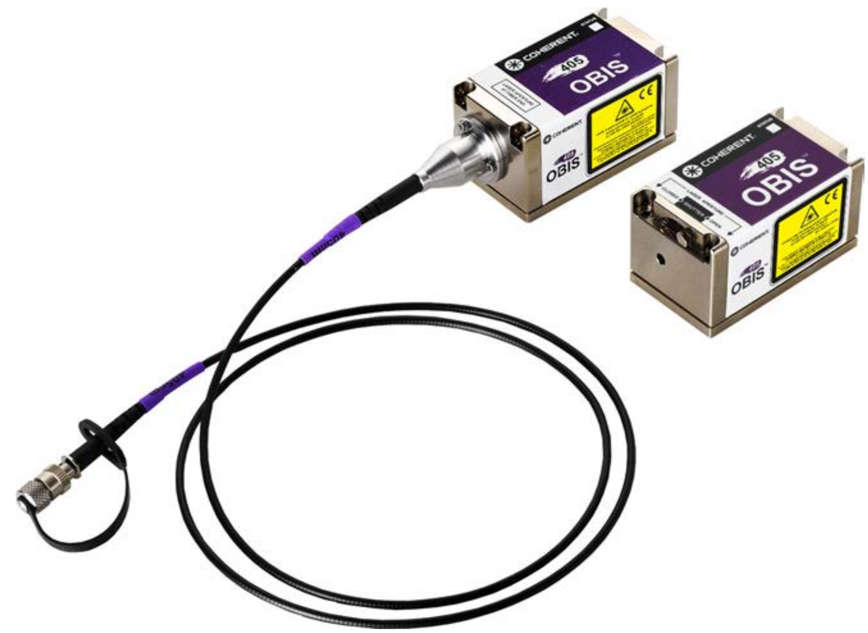
OBIS® LX/LS Lasers

Operator's Manual

COHERENT®
Superior Reliability & Performance

OPERATOR'S MANUAL
OBIS LX/LS LASERS



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

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Technical Support

In the U.S.:

Should you experience any difficulties with your laser or need any technical information, please visit our website: www.Coherent.com. Should you need further assistance, please contact Coherent Technical Support via e-mail: Product.Support@Coherent.com or telephone: 1-800-367-7890 (1-408-764-4557 outside the U.S.). Please be ready to provide model and laser serial number of your laser system as well as the description of the problem and any corrective steps attempted to the support engineer responding to your request.

Telephone coverage is available Monday through Friday (except U.S. holidays). Inquiries received outside normal office hours will be documented by our automatic answering system and promptly returned the next business day.

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Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability thereby for any injury or damage that may occur contemporaneous with such services. Under no circumstances do these support services affect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks (or safety features) defeated is always at the operator's own risk.

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PREFACE

This manual includes user information for the Coherent OBIS LX and OBIS 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!
The use of controls, adjustments, or performance of procedures—except those specified in this manual—can cause dangerous radiation exposure.

Safety Warnings

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

NOTICE!
Read this manual before operating the laser for the first time. Pay special attention to the material in "Section One: Laser Safety" (p. 1-1), which describes the safety features of the laser.

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.

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:

Preface Table-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.

Symbols

The signal words **DANGER**, **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level. The icons are intended to alert the operator as described in Table 2:

Preface Table-2. Safety Symbols

ICON	ALERTS THE OPERATOR ABOUT...
	Important operating and maintenance instructions.
	Danger of exposure to hazardous visible and invisible laser radiation.
	Dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.
	Danger of susceptibility to Electro-Static Discharge (ESD).
	Danger of a crushing injury.
	Danger of a lifting hazard.

Export Control Laws Compliance

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.

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.

Receiving and Inspection

Inspect all shipping boxes for any indication of damage, and 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 Table 9-1 (p. 9-1) for a list of parts shipped with each system.

NOTICE!
After unpacking the system, save the shipping boxes for potential later shipments—refer to "Section Nine: OBIS Laser Repacking Procedure" (p. 9-1) for repacking instructions.

PRÉFACE (TRADUCTION FRANÇAISE)

Ce manuel contient les informations destinées à l'utilisateur du système laser OBIS, conçu par la firme Coherent, qui consiste en une tête laser et un mini contrôleur.

AVERTISSEMENT!
L'utilisation de procédures de contrôle ou de réglage des performances autres que celles spécifiées ci-après peut entraîner un risqué d'exposition dangereuse au rayonnement laser.

Mots indicateurs et symboles utilisés dans ce manuel

La présente documentation peut contenir des sections dans lesquelles des dangers particuliers sont définis ou une attention spéciale est portée à des conditions spécifiques. Ces sections sont signalées par des mots indicateurs, conformément à la norme ANSI Z-535.6, ainsi que des symboles de sécurité (alertes de danger par pictogramme) conformément aux normes ANSI Z-535.3 et ISO 7010.

AVIS!
Lire attentivement ce manuel avant d'utiliser le laser pour la première fois. Une attention particulière devra être portée à la "Section One: Laser Safety" (p. 1-1), qui décrit les précautions à prendre avec le laser.

Mots indicateurs

Cette documentation fait usage de quatre mots indicateurs: **DANGER**, **AVERTISSEMENT**, **MISE EN GARDE** et ***AVIS***.

Les mots indicateurs **DANGER**, **AVERTISSEMENT** et **MISE EN GARDE** indiquent le degré ou niveau de danger en présence d'un risque immédiat de blessures graves:

Preface Table-3. Mots Indicateurs

SIGNAL WORD	DESCRIPTION
DANGER!	Indique une situation dangereuse qui, si elle n'est pas évitée, entraînera **la mort ou des blessures graves**. Ce mot indicateur est réservé aux situations les plus graves.
AVERTISSEMENT!	Indique une situation dangereuse qui, si elle n'est pas évitée, peut entraîner **la mort ou des blessures graves**.
MISE EN GARDE!	Indique une situation dangereuse qui, si elle n'est pas évitée, pourrait entraîner **des blessures légères ou modérées.**
NOTICE	Le mot indicateur "***AVIS***" est utilisé lorsqu'un risque de dommages matériels existe. Indique des informations considérées comme importantes, mais ne constituant pas un danger.

Les messages relatifs aux dangers pouvant entraîner à la fois des blessures et des dommages matériels sont considérés comme des messages concernant la sécurité et non comme des messages avertissant de la possibilité de dégâts matériels.

Symboles

Les mots indicateurs **DANGER**, **AVERTISSEMENT**, et **MISE EN GARDE** sont toujours mis en évidence par la présence d'un symbole de sécurité indiquant un danger spécifique, sans égard au niveau de ce danger:

Preface Table-4. Symboles

ICON	ALERTS THE OPERATOR ABOUT…
	**Ce symbole est destiné à alerter l'opérateur de la présence d'instructions importantes concernant le fonctionnement ou l'entretien/la réparation.**
	**Ce symbole est destiné à alerter l'opérateur de l'existence de risques d'exposition aux radiations laser, visibles ou invisibles.**
	**Ce symbole est destiné à alerter l'opérateur de l'existence de tensions dangereuses à l'intérieur du boîtier ou carter de l'appareil, d'une importance suffisante pour constituer un risque d'électrocution.**
	**Ce symbole est destiné à alerter l'opérateur de l'existence de décharges électrostatiques (DES).**
	**Ce symbole est destiné à alerter l'opérateur de l'existence d'un danger d'écrasement.**
	**Ce symbole est destiné à alerter l'opérateur de l'existence d'un risque de levage.**

Conformité avec les lois de contrôle des exportations

Coherent a pour politique de se conformer strictement aux lois de contrôle des exportations des États-Unis.

L'exportation et la réexportation des lasers construits par Coherent sont sujettes aux règlements d'administration des exportations des États-Unis, gérés par le département américain du commerce. En outre, les expéditions de certains composants sont réglementées par le département d'État en vertu de la réglementation visant le trafic international d'armes.

Les restrictions applicables varient selon le produit spécifique impliqué et sa destination. Dans certains cas, la loi des États-Unis exige que l'accord du gouvernement des États-Unis soit obtenu avant la revente, l'exportation ou la réexportation de certains articles. Quand il y a incertitude sur les obligations imposées par la loi des États-Unis, une clarification doit être obtenue auprès de Coherent ou d'un organisme gouvernemental compétent des États-Unis.

Produits fabriqués à l'intérieur de l'union européenne, Singapour, en Malaisie, Thaïlande: Ces marchandises, technologies ou logiciels sont sujet aux lois locales ainsi qu'aux régulations d'exportation locales. Toutes déviations contraires aux lois locales sont interdites. L'utilisation, la vente, la réexportation, ou le transfert direct ou indirect dans toutes activités illégales sont strictement interdites.

Réception et inspection

Inspecter les caisses et emballages d'expédition et noter toutes traces de manutention brutale ou de dommages et en porter mention sur la lettre de transport. Faire immédiatement rapport de tout dommage au transporteur et, soit au département de gestion des commandes de Coherent (Order Administration Department) au numéro 1 (408) 764-4557 (aux États-Unis, au 1-800-367-7890) ou au représentant autorisé de Coherent.

AVIS!
Après le déballage du système, conserver caisses et emballages pour réexpédition ultérieure éventuelle - voir “Section Nine: OBIS Laser Repacking Procedure” (p. 9-1).

SECTION ONE: LASER SAFETY

This section describes critical safety information about:

- Hazards (this page)
- Optical Safety (p. 1-2)
- Electrical Safety (p. 1-6)
- Compliance with Government Requirements (p. 1-11)
- Location of Safety Labels (p. 1-15)

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!

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.

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.

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" on page 3. 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.
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.

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.

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 1-1 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) Lasers.

Table 1-1. Maximum Emission of OBIS LX Lasers

WAVELENGTH 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	≤ 475 mW
422 nm	≤ 100 mW	0.40 – 0.44 µm	≤ 200 mW
445 nm	≤ 100 mW	0.43 – 0.46 µm	≤ 200 mW
458 nm	≤ 100 mW	0.44 – 0.47 µm	≤ 200 mW
473 nm	≤ 100 mW	0.46 – 0.49 µm	≤ 200 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 - 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
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

The beam diameter of an OBIS Laser at the aperture is in the range of 0.65 to 0.75mm with an M^2 of <1.1.

Considering the maximum power according to Table 1-1 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) 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.

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 1-2 lists the applicable emission parameters for OBIS LS (OPSL) and OBIS LS FP (OPSL, Pigtailed) Lasers.

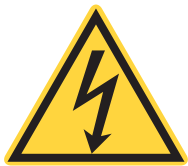
Table 1-2. Maximum Emission of OBIS LS Lasers

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… 120 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
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

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.

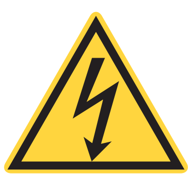
Although the electronics features have input protection, permanent damage can occur on devices subjected to high-energy electrostatic discharges. You must take correct ESD precautions to prevent damage or performance degradation.

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.

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.

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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.

Safety Features

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

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***.

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.

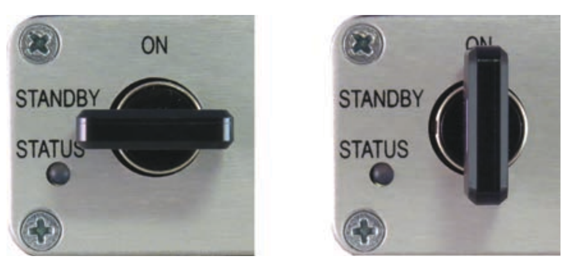
Protective Housing

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.

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 1-1.



STANDBY Position ***ON Position***

Figure 1-1. 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 1-6 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. 2-12).

Table 1-1 lists the LED indicator on the OBIS 6-Laser Remote. For more information about operation of this Remote, refer to Table 10-2 (p. 10-4).

Table 1-3. 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.

Laser Emission Indicator

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

Figure 1-2. 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.

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—see Table 10-2 (p. 10-4).

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 1-3.

Individual Laser Power ON/OFF Switches

Figure 1-3. OBIS 6-Laser Remote Power ON/OFF Switches

Shutter

The OBIS Laser has a manually-operated shutter at the beam exit aperture on the front of the laser, as shown in Figure 1-4. When the shutter is closed, there is no laser radiation sent from the laser.

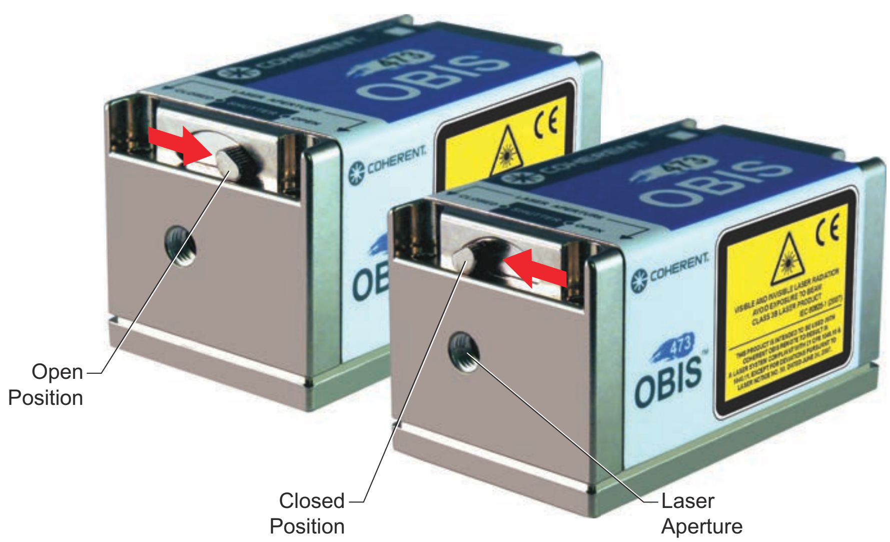


Figure 1-4. Shutter in Open and Closed Positions

The OBIS fiber-pigtailed laser has a metal shutter cap (rather than a mechanical shutter), as shown in Figure 1-5. When the shutter cap is closed, there is no laser radiation sent from the laser.

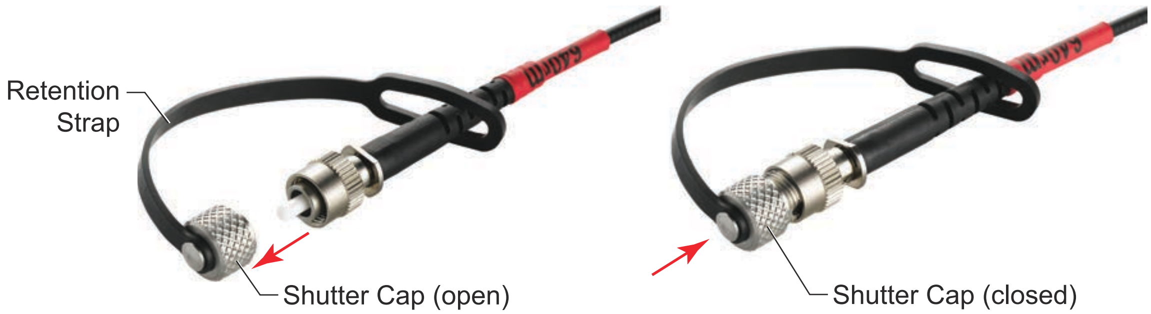


Figure 1-5. OBIS FP Shutter Cap in Open and Closed Position

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

NOTICE!
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. 3-10).

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 1-6 shows a diagram of the remote interlock circuit configuration. The remote interlock is applicable to OBIS LX and OBIS LS systems.

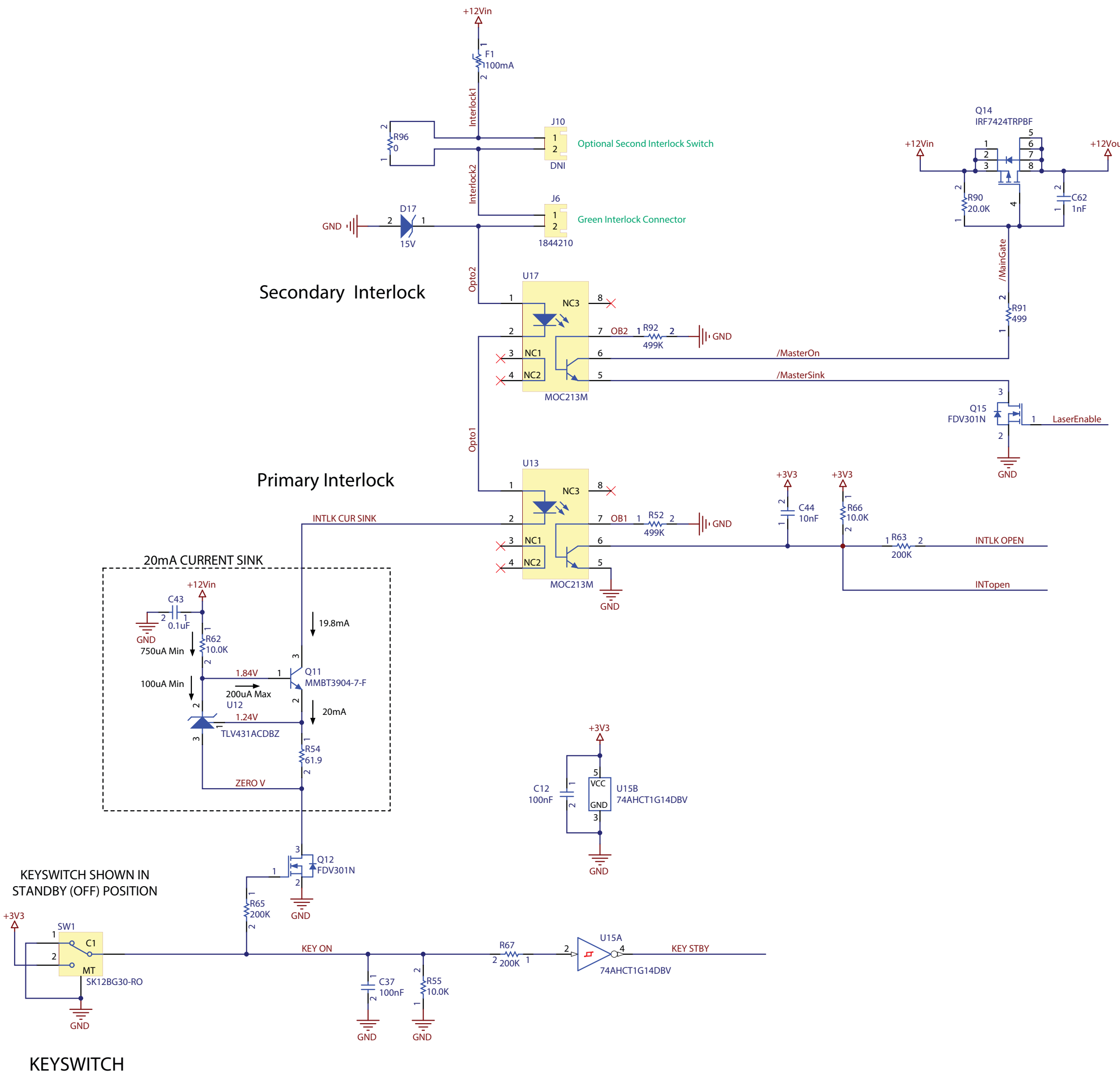


Figure 1-6. Remote Interlock Circuit and Keyswitch Diagram for Controllers

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.

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

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.

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.

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).

IMPORTANT!
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 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.

Declaration of Conformity

Declaration of Conformity certificates are available upon request. Contact your Coherent representative or Coherent Technical Support (telephone: 1-(800)-367-7890 or 1-(408)-764-4557 outside the U.S., or e-mail: Product.Support@Coherent.com).

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.

EMI Standard for Emissions per:

IEC/CISPR 11:2009 + A1:2010 (for OBIS LS)
Class A Radiated Emissions

IEC/CISPR 11:2009 + A1:2010 (for OBIS LS)
Class A Conducted Emissions

EN61000-3-2:2009
Power Line Harmonics

EN61000-3-3:2008
Power Line Voltage Fluctuation and Flicker

EMC Standard for Immunity per:

IEC 61326-2:2012
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

Low Voltage Directive 73/23/EEC Tests per:

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

MD – Machinery Directive for Laser Devices Tests per:

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

EN60825-2:2005
Safety of Laser Products – Part 2: Safety of Optical Fiber Communication Systems

EN60825-12:2004
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

EU REACH

Coherent products are classified as “articles” according to EU REACH definition as follows:

Article means an object which during production is given a special shape, surface or design which determines its function to a greater degree than its chemical composition. (REACH, Article 3(3))

Articles as defined by REACH regulations are exempt from registration as long as they are not intended to release a chemical substance.

To the best of our knowledge, all Coherent product meet the definition of “article” according to REACH.

In addition, to the best of our knowledge, Coherent products do not contain any substances of very high concern (SVHC) above the threshold limit included in the REACH SVHC list updated which is update every six month. The full SVHC list is available on-line at:

https://echa.europa.eu/candidate-list-table

Waste Electrical and Electronic Equipment (WEEE)

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is represented by a crossed-out garbage container label.

The purpose of this 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 1-7, is affixed to the cover of the OBIS Laser.

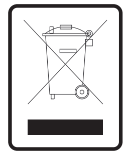


Figure 1-7. Waste Electrical and Electronic Equipment Label

RoHS Compliance

The RoHS directive restricts the use of certain hazardous substances in electrical and electronic equipment. Coherent can provide RoHS certification upon request for products requiring adherence to the RoHS Directive.

Compliance of this laser with the EMC requirements is certified by the CE mark.

China RoHS Compliance

To comply with the China RoHS (Restriction of Hazardous Substances) Directive effective March 1, 2007, a table of hazardous substances is included in this manual that shows which of the offending substances is found in the OBIS Laser System.

The example in Figure 1-8 shows that Lead (Pb) is found in the OBIS Laser System (because of the use of brass material) and that the environmental-friendly use period is 20 years (indicated by the 20 inside the circle).

铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
Pb	Hg	Cd	$Cr6^+$	PBB	PBDE
X	O	O	O	O	O

O=小于最高浓度值 X=大于最高浓度值

Figure 1-8. China RoHS Table of Restricted Hazardous Substances

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 1-9.

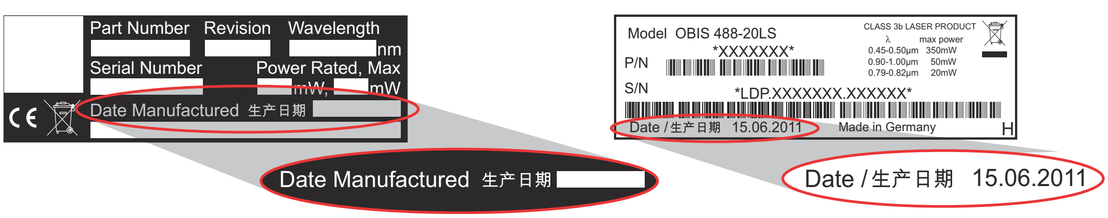


Figure 1-9. China RoHS Date of Manufacture

Location of 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].

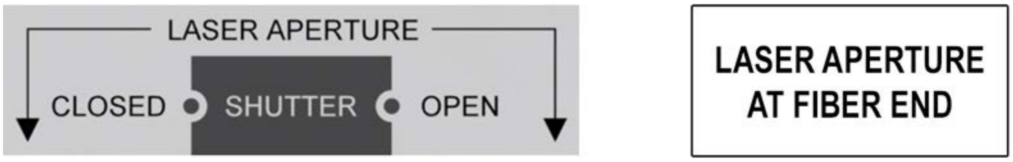
Figure 1-10 shows the location of the safety labels on the OBIS laser.

Figure 1-10. Safety Labels on the OBIS Laser

Figure 1-11 shows the wording on the Laser Safety label.

Figure 1-11. Laser Safety Label

Figure 1-12 shows labels that indicate locations for the laser aperture.



OBIS OBIS FP

Figure 1-12. Labels for Laser Aperture Locations

Figure 1-13 shows examples of product-specific information, including the part number, serial number, date of manufacture, power and wavelength for each laser.

Figure 1-13. Product-Specific Information

Première Section: Sécurité Laser (Traduction Française)

Dans cette section:

- Sécurité optique (cette page)
- Sécurité electrique (p. 1-20)
- Lasers et dispositifs de sécurité (p. 1-21)

Sécurité Optique

La lumière laser, du fait de ses propriétés particulières, ne présente pas les mêmes risques que les autres sources lumineuses traditionnelles. L'utilisation de laser en toute sécurité exige que tout utilisateur de laser, ainsi que toute personne approchant un système laser, connaisse les dangers inhérents à l'utilisation d'une telle source lumineuse. L'utilisation sécurisée de laser dépend de l'habitude qu'a l'utilisateur des instruments et des propriétés d'une lumière cohérente et intense.

DANGER!
Le contact direct du faisceau laser avec l'œil peut provoquer des lésions importantes et une possible cécité.

Table 1-1. << Puissance maximale des lasers OBIS LX (Diode) et OBIS LS FP (Diode, Version Avec Fibre)>>

Classe de Longeurs d'Ondes	Classe de Puissance	Longeurs d'Ondes Émises	Puissance Maximale
375 nm	≤ 50 mW	0.36 – 0.39 µm	≤ 100 mW
405 nm	≤ 400 mW	0.39 – 0.42 µm	≤ 475 mW
422 nm	≤ 100 mW	0.40 – 0.44 µm	≤ 200 mW
445 nm	≤ 100 mW	0.43 – 0.46 µm	≤ 200 mW
458 nm	≤ 100 mW	0.44 – 0.47 µm	≤ 200 mW
473 nm	≤ 100 mW	0.46 – 0.49 µm	≤ 200 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 - 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
730 nm	≤ 100 mW	0.71 – 0.75 µm	≤ 200 mW
785 nm	≤ 100 mW	0.77 – 0.80 µm	≤ 200 mW

***Table 1-1.** << Puissance maximale des lasers OBIS LX (Diode) et OBIS LS FP (Diode, Version Avec Fibre)>>*

CLASSE DE LONGEURS D'ONDES	CLASSE DE PUISSANCE	LONGEURS D'ONDES ÉMISES	PUISSANCE MAXIMALE
808 nm	<=150 mW	0.79 – 0.82 µm	≤ 250 mW
980 nm	<=150 mW	0.97 – 0.99 µm	≤ 250 mW

***Table 1-2.** << Puissance maximale des lasers OBIS LS (OPSL) et OBIS LS FP (OPSL, Version Avec Fibre)>>*

CLASSE DE LONGEURS D'ONDES	CLASSE DE PUISSANCE	LONGEURS D'ONDES ÉMISES	PUISSANCE MAXIMALE
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… 120 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
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

Table 1-2. << Puissance maximale des lasers OBIS LS (OPSL) et OBIS LS FP (OPSL, Version Avec Fibre)>>

Classe de Longeurs d'Ondes	Classe de Puissance	Longeurs d'Ondes Émises	Puissance Maximale
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

Les faisceaux laser peuvent enflammer des substances volatiles comme l'alcool, l'essence, l'éther ou d'autres solvants et peuvent endommager des éléments sensibles à la lumière comme les caméras vidéo, les photomultiplicateurs et les photodiodes. Les faisceaux réfléchis peuvent aussi induire des dommages. Pour toutes ces raisons, il est conseillé à l'utilisateur de suivre les précautions suivantes.

1. Observer toutes les précautions de sécurité stipulées dans le manuel de l'utilisateur.
2. Une attention particulière doit être observée lorsque des solvants sont utilisés dans la même salle que le laser.
3. L'utilisation de laser doit être limitée aux personnes qualifiées et habituées à une utilisation sans risque des lasers et informées de leurs dangers.
4. Ne jamais regarder directement le faisceau laser ou la lumière diffusée par une surface réfléchissante. Ne pas renvoyer la lumière laser vers la source laser.
5. Maintenir le montage expérimental à une faible hauteur pour éviter toute rencontre du faisceau laser avec les yeux.

ADVERTISSEMENT!
Les lunettes de sécurité laser peuvent présenter un risque aussi bien qu'un avantage ; elles protègent les yeux d'une exposition potentiellement dangereuse et elles bloquent la lumière aux longueurs d'onde du laser, ce qui empêche l'opérateur de voir le faisceau laser. Par conséquent, veiller à maintenir une attention particulière, même avec l'utilisation de lunettes de sécurité.

6. Afin d'éviter une exposition accidentelle au faisceau de sortie du laser ou à une de ses réflexions, les utilisateurs du système doivent porter

des lunettes de sécurité dont la densité optique est dictée par la longueur d'onde que génère le laser.

7. Utiliser le laser dans une pièce fermée. La lumière laser doit rester collimatée sur une longue distance et peut ainsi présenter un risque si elle n'est pas confinée.
8. Placer des panneaux d'avertissement dans la zone où se trouve le faisceau laser pour avertir les personnes présentes.
9. Avertir tous les utilisateurs de laser de ces précautions. Il est préférable de se servir du laser dans une pièce sous accès contrôlé et limité.
10. Lors du processus d'alignement du laser, ne pas porter de vêtements ou d'objets présentant des surfaces réfléchissantes (par exemple, montre ou bijoux).

Sécurité Electrique

Ne pas ouvrir le boîtier de l'appareil. Il ne contient pas de pièces réparables par l'utilisateur. Tous les appareils sont conçus pour fonctionner dans l'état où ils ont été assemblés en usine. Toute ouverture du boîtier entraîne l'annulation de la garantie.

MISE EN GARDE!
Des charges électrostatiques d'une intensité pouvant atteindre 4000 volts peuvent aisément être accumulées sur le corps humain et peuvent être déchargées rapidement et sans détection. Bien que l'électronique de l'appareil bénéficie de protections d'entrée remarquables, les décharges électrostatiques sont susceptibles d'infliger des dommages permanents aux appareils soumis aux décharges électrostatiques de forte intensité. Pour cette raison, les précautions d'usage contre les décharges électrostatiques sont recommandées afin d'éviter les baisses de performance.

Les dommages les plus fréquemment observés sont occasionnés lors du maniement de l'appareil au cours de son installation ou de son utilisation. Prendre les mesures appropriées pour protéger le système des décharges électrostatiques.

Des conditions telles que la sécheresse de l'air ambiant et la présence de tapis et moquettes peuvent accentuer les risques d'accumulation de charges électrostatiques. Des précautions particulières ou la mise en place d'un blindage contre les décharges électrostatiques doivent être envisagées lors des démonstrations, salons professionnels ou foires commerciales.

Lasers et dispositifs de sécurité

Conformité à la norme CDRH/IEC 60825-1

Lorsqu'elle est utilisée avec son mini-contrôleur, la tête laser OBIS est conforme aux normes de sécurité relatives aux produits laser de classe 1 en matière de rayonnement, établies par le CDRH (Center for Devices and Radiological Health) de la FDA (Food and Drug Administration) des États-Unis (21 CFR 1040.10 et 1040.11, sauf pour ce qui tient aux exceptions relatives à la note sur les lasers n° 50 datée du 26 juillet 2001) et la norme IEC 60825-1. Pour prendre connaissance d'une liste des numéros d'enregistrement de l'appareil auprès du CDRH, complète à la date de la publication du présent document, veuillez ouvrir *141037 rAA - OBIS CDRH Accession Numbers.pdf* sur la clef USB livrée avec votre produit. Pour prendre connaissance de la liste de numéros d'enregistrement la plus récente, veuillez consulter ici.

En plus de leur conformité aux normes CDRH et IEC 60825-1, la famille des produits OBIS a reçu une homologation décernée par un laboratoire indépendant et a été déclarée conforme aux directives environnementales et sécuritaires dont la liste suit.

EMI Standard for Emissions per:

IEC/CISPR 11:2009 + A1:2010 (for OBIS LS)
Class A Radiated Emissions

IEC/CISPR 11:2009 + A1:2010 (for OBIS LS)
Class A Conducted Emissions

EN61000-3-2:2009
Power Line Harmonics

EN61000-3-3:2008
Power Line Voltage Fluctuation and Flicker

EMC Standard for Immunity per:

IEC 61326-2:2012
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

Low Voltage Directive 73/23/EEC Tests per:

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

MD – Machinery Directive for Laser Devices Tests per:

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

EN60825-2:2005
Safety of Laser Products – Part 2: Safety of Optical Fiber Communication Systems

EN60825-12:2004
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

Déclaration deconformité

« Les certificats de conformité sont disponibles sur demande »

Limites d'émission et classification laser

Le système laser OBIS a été déclaré appartenir à la Classe IIIb par le CDRH (Center for Devices and Radiological Health) des États-Unis. Il est susceptible d'émettre des RAYONNEMENTS LASER VISIBLES ou INVISIBLES sur les longueurs d'onde de 0,3 à 1,0 m de distance de l'ouverture située devant la tête laser.

Boîtier protecteur

Le rayonnement laser est entièrement confiné dans un boîtier métallique protecteur, sauf pour ce qui est de l'ouverture ménagée pour le rayon laser. Le boîtier protecteur ne doit jamais être ouvert.

Verrouillage à distance

Le mini-contrôleur est muni d'un circuit de verrouillage à distance qui empêche la production de rayonnement laser lorsque ce circuit est ouvert. Ce circuit de verrouillage est muni de sécurités intégrées de façon redondante. La Figure 1-1 on page 1-23 montre un diagramme de la configuration du circuit de verrouillage à distance. Le connecteur de verrouillage est situé sur le mini-contrôleur et peut être utilisé avec les systèmes LS et LX.

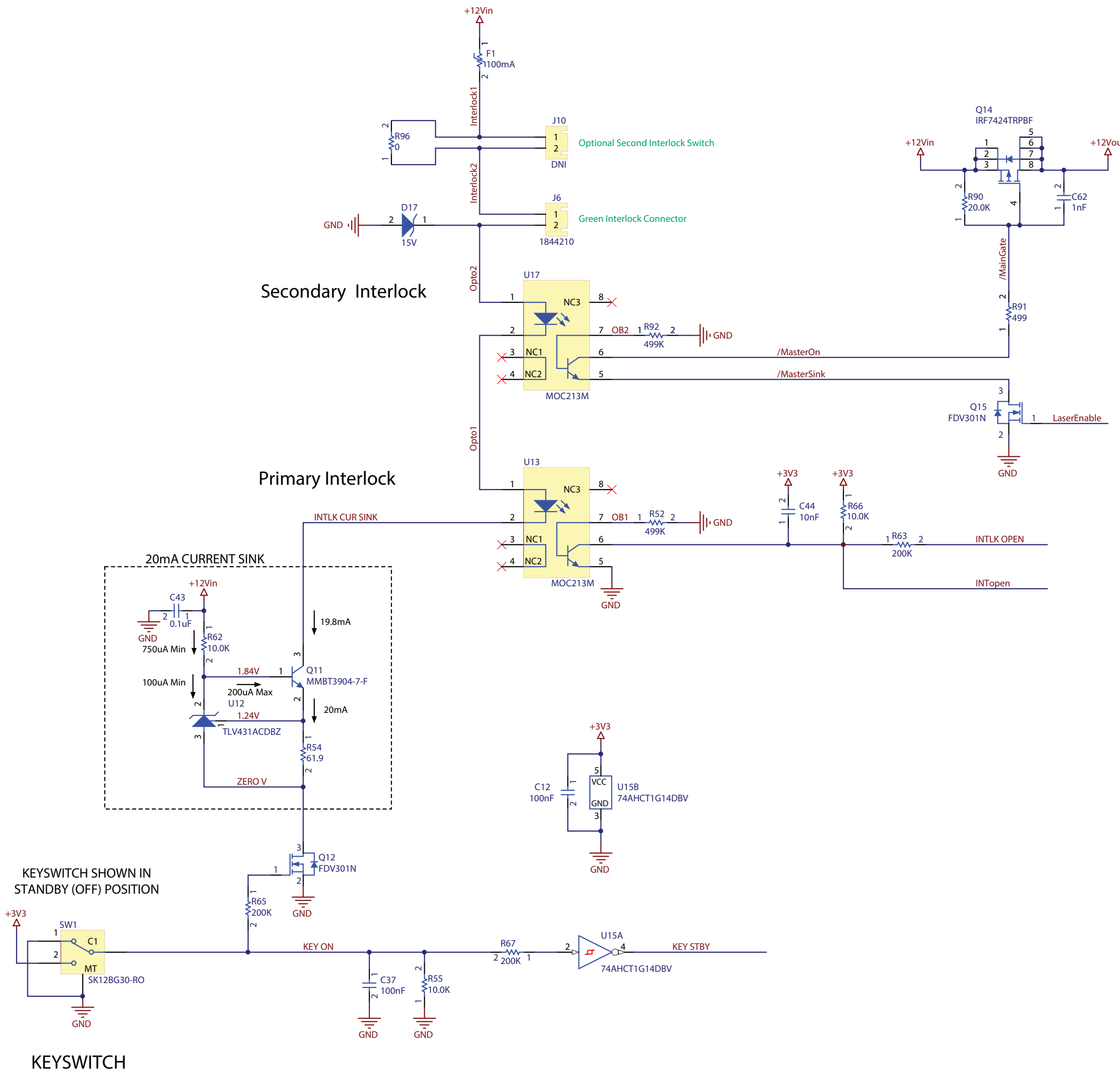


Figure 1-1. Diagramme du circuit de verrouillage et du commutateur à clef

Interrupteur à clef

La commande à distance OBIS est équipée d'un commutateur à clef empêchant l'émission de radiation laser lorsqu'il est placé dans la position STANDBY (mise en veille). La radiation laser peut être émise lorsque la clef est placée dans la position ON (marche). La clef peut être retirée lorsqu'elle se trouve en position STANDBY ; elle ne le peut lorsqu'elle est mise en position ON.

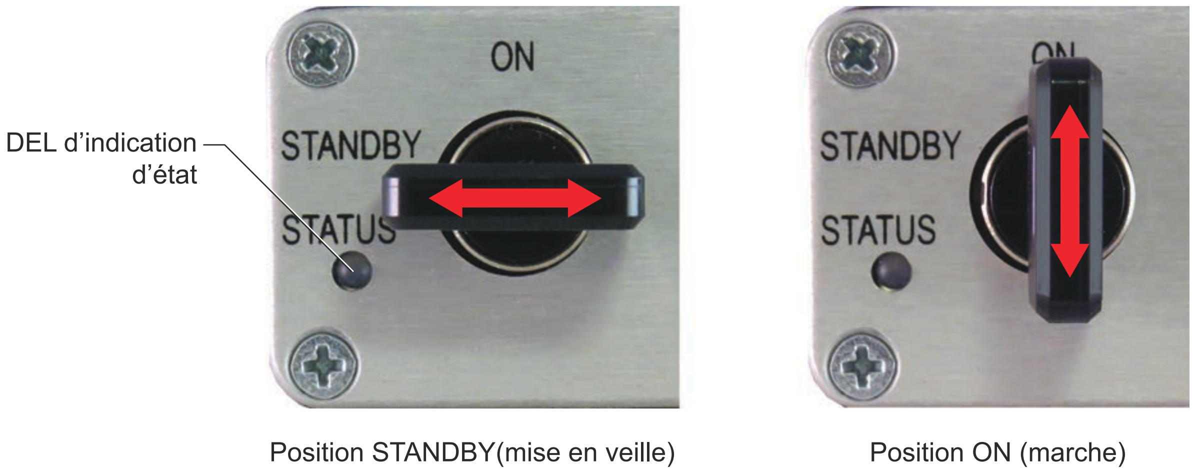


Figure 1-2. L'interrupteur à clef pour commande à distance OBIS

Le fonctionnement de l'interrupteur à clef assure la même fonction que la réinitialisation manuelle CDRH: après une erreur du mécanisme d'interdiction ou une interruption de la tension, le laser ne redémarre pas automatiquement, à moins que l'interrupteur à clef n'ait été 1) remis en position STANDBY, puis 2) replacé en position ON. La figure 1-1 (p. 1-23) contient les informations relatives au circuit de l'interrupteur à clef.

La diode indicatrice d'état du panneau avant s'allume en vert, bleu ou rouge, reflétant le réglage fait sur la commande à distance OBIS. *Pour plus d'informations concernant la DEL d'état de la commande à distance de la commande à distance OBIS 6-Laser, veuillez vous reporter à la section “ Status LED Indicator ” (p. 2-9).*

Le tableau ci-dessous est le tableau de vérité de la DEL indicatrice d'état de la commande à distance OBIS.

Table 1-3. États de la DEL de la commande à distance OBIS

POSITION INTERRUPTEUR A CLÉ INDICATEURS LED	POSITION INTERRUPTEUR A CLE	ETAT INTERRUPTEUR DE SÉCURITÉ
Jaune	pas applicable - initialisation	pas applicable
Clignote en bleu	Erreur: Keyswitch était ON au démarrage. Basculer keyswitch retour en veille pour effacer l'erreur.	pas applicable
Bleu	STANDBY	X
Verte	ON	Fermé
Rouge	ON	Interlock ouvert, provo-quant un erreur

Pour plus de détails, se reporter au Tableau 10-2 (p. 10-4).

AVERTISSEMENT!
Lorsque l'interrupteur à clef est en position ON, le plot de verrouillage est connecté et les interrupteurs du laser sont en position ON et allumés: l'émission laser est possible.

Indicateurs d'émission de laser

Le mini-contrôleur du système comporte un indicateur d'émission laser, situé sur le panneau avant. Lorsque le voyant DEL indicateur n'est pas allumé, la présence de rayonnement laser n'est pas possible. Lorsque le voyant est allumé, le laser doit être considéré comme dangereux ; un faisceau laser peut être produit à tout moment (par exemple par l'intermédiaire d'une commande informatique). Après l'allumage du voyant DEL blanc, un délai est ménagé avant l'émission effective d'un rayonnement laser, ce qui permet à l'opérateur de prendre les mesures appropriées pour éviter l'exposition au faisceau laser. Ce délai d'attente est d'au moins cinq secondes.

Figure 1-3. Indicateur d'émission de laser

Les LED situées au-devant du "OBIS 6-Laser Remote" n'indiquent pas l' Etat d'émission du Laser mais celui de la télécommande de control—Cf. Table 10-2 (p. 10-4).

Les canaux pour lesquels une émission Laser est possible sont indiqués par les interrupteurs ON/OFF

Figure 1-4. "OBIS 6-Laser Remote Power" Interrupteurs ON/ OFF

Exposition aux rayonnements

AVERTISSEMENT!
L'utilisation de commandes, de réglages ou l'exécution de procédures autres que celles spécifiées dans ce manuel peuvent entraîner l'exposition à des rayonnements dangereux.

Mécanisme d'obturation

Le laser comporte un obturateur à commande manuelle situé au niveau d'ouverture destinée au faisceau laser, devant la tête laser. Lorsque l'obturateur est totalement clos, aucun rayonnement laser n'est émis.

AVIS!
N'utiliser que des gants Nitrile pour manipuler les fibres optiques- Ne jamais toucher les extrémités des fibres.

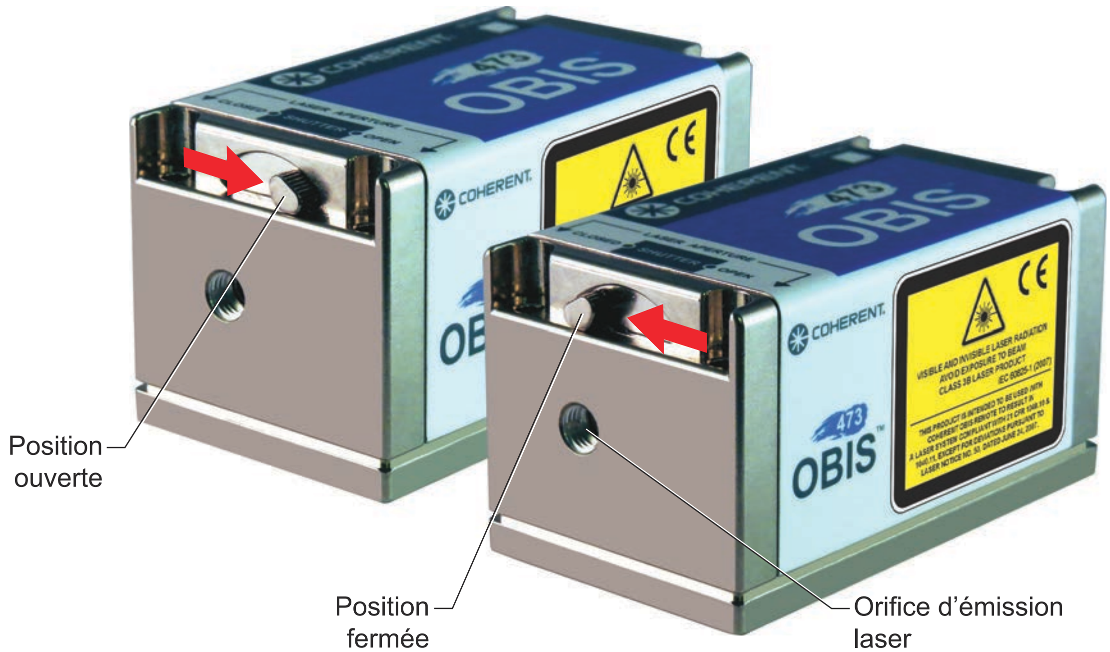


Figure 1-5. Commande manuelle de l'obturateur en position ouverte et fermée

AVIS!
Ne Libérer l'extrémité de la fibre optique que dans un environnement propre et exempt de matière organique et de particules. Ces contaminations pourraient entraîner une dégradation des fibres. Vérifier la propreté de cette dernière avant tour utilisation du Laser. Nettoyer la pointe de la fibre à l'aide d'outils et matériels spécifiques afin de ne pas endommager la pointe de la fibre. Pour plus d'informations, reportez-vous à <<Étape 8 : Nettoyage de la fibre Astuce OBIS (p. 3-10)

Figure 1-6. OBIS FP bouchon d’obturation en position ouverte et fermée

Waste Electrical and Electronic Equipment (WEEE, 2002)

La directive européenne << Waste Electrical and Electronic Equipment >> (WEEE) (2002/96/CE) est symbolisée par l'image d'une poubelle barrée. Le but de cette directive est de minimiser l'impact des déchets d'équipements électriques et électroniques sur l'environnement et de faciliter la mise au rebut appropriée de ces produits. L'étiquette portant le symbole de la poubelle barrée est apposée sur le boîtier de la tête du laser OBIS.

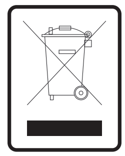


Figure 1-7. Étiquette portant le symbole de la directive << Waste Electrical and Electronic Equipment >>

Emplacement des étiquettes de sécurité

Se référer à la Figure 1-8 pour l'emplacement des étiquettes de sécurité.

Figure 1-8. Etiquettes de Sécurité*4 *(Sheet 1 of 2)

Figure 1-8. Etiquettes de Sécurité4 (Sheet 2 of 2)

Conformité au RoHS

Pour se conformer à la directive chinoise RoHS (Restriction of Hazardous Substances), entrée en vigueur le 1er mars 2007, un tableau énumérant les substances dangereuses est inclus dans ce manuel. Il indique celles des substances irrégulières citées par cette directive sont présentes dans le système laser OBIS.

Figure 1-9. Tableau conforme à la directive chinoise RoHS indiquant les substances dangereuses soumises à des restrictions

Le tableau de la Figure 1-9, ci-dessus, indique la présence de plomb (Pb) dans le système laser OBIS (elle est due à l'utilisation de laiton dans l'appareil) et que sa période d'utilisation sans risques pour l'environnement est de vingt ans, comme indiqué par le nombre 20 entouré d'un cercle.

La directive chinoise RoHS requiert également que la date de fabrication du système laser OBIS soit apposée sur le produit (en caractères chinois). Ceci est fait sur l'étiquette conforme/non conforme. Prière de se référer à l'illustration suivante.

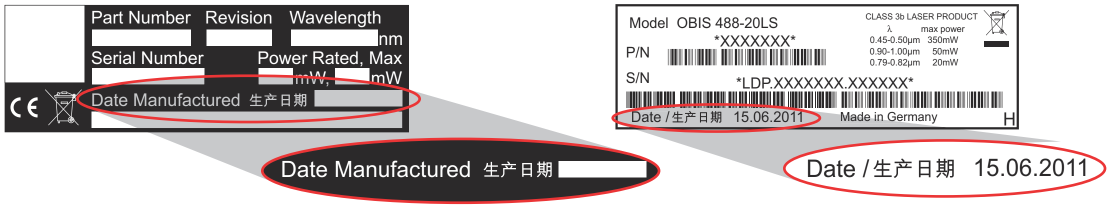


Figure 1-10. Date de fabrication pour la directive chinoise RoHS

SECTION TWO: THE OBIS LX/LS LASER SYSTEM

In this section:

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, refer to "Appendix B: OBIS Accessories Parts List" (p. B-1).

Table 2-1. OBIS Laser System Components and Accessories

ITEM	DESCRIPTION	PART NUMBER
1	OBIS LX/LS Laser	See website
2	OBIS Remote (Single Laser)	1173961
3	Power cord, USA to IEC-320	Contact Product Support (p. B-1)
4	Power supply, 110/220V AC, 12V DC, IEC-320	1184491
5	Mounting brackets/hardware for OBIS Remote	Contact Product Support (p. B-1)

Table 2-1. OBIS Laser System Components and Accessories (continued)

ITEM	DESCRIPTION	PART NUMBER
6	Laser mounting bolts/washers (M3 x 35 mm / 0.19” O.D., 4 each)	Contact Product Support (p. B-1)
7	Wavelength labels for OBIS Remote	Refer to 1190348 in Table B-1
8	Cable, SDR, laser to OBIS Remote (1 meter) Optional 0.3 meter and 3 meter cables sold separately—see Table B-1	1179451
9	USB cable, Type A to Type Mini-B (1.8 meters)	1108906 in Table B-1
10	OBIS Laser Safety and Installation Quick Start Guide	1185449
11	OBIS LX/LS Operator’s Manual (PDF file on USB memory drive)	1184163
12	Interlock, shorted, for OBIS Remote	Refer to 1190348 in Table B-1
13	Keys for OBIS Remote (2 each)	
14	USB memory drive for software control	

Table 2-2 lists other products that support the OBIS laser system. For more information, see the page numbers listed.

Table 2-2. Supporting OBIS Products

PRODUCT		PRODUCT	
	6-Laser Remote, see p. 10-1		LaserBox, see p. 12-1
	Scientific Remote, see p. 11-1		Galaxy Beam Combiner, see p. 13-1

Description

OBIS LX (Direct Diode) and OBIS LS (OPSL) laser products come with many accessories to support your 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 has 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 violet to the near IR. Fiber termination is complete with a FC/APC connector.

Based off the OBIS Laser platform, OBIS FP lasers offer plug-and-play simplicity that allows for faster integration, which reduces the cost of integration and time-to-market.

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 utilizes proprietary fiber technology to provide superior lifetimes and a permanent fiber attachment for a guaranteed power over time.

OBIS FP lasers are now compatible with MetaMorph® and µManager™ software for microscopy automation and image analysis.

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 because the cable specifications can vary.

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 Lasers

For details about specific product performance, refer to the OBIS Data Sheet at:

https://cohrstage.coherent.com/assets/pdf/COHR_OBISfamily_DS_0517_1.pdf

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
- Maximum digital modulation control
    - 150 MHz (LX version)
    - 0.05 MHz (LS version)
- Maximum bandwidth for analog modulation control
    - 500 kHz (LX version)
    - 100 kHz (LS version)]
- 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)
- Laser Notices

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

The laser (either free-space or fiber pigtailed) is the base module for the OBIS Laser System and can be used as a 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. For information, refer to "OBIS Communications through a Terminal Program" (p. 6-5).

NOTICE!
To be CDRH compliant, you *must* use an OBIS Remote 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.

NOTICE!
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.

Front Panel

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

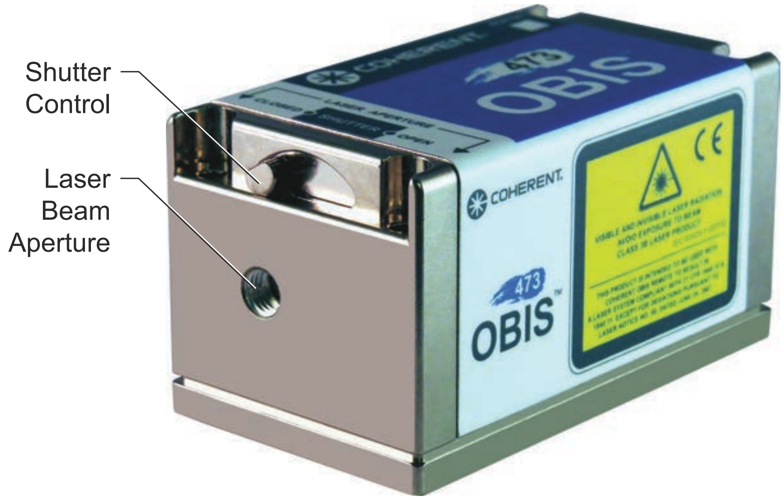


Figure 2-3. OBIS Laser Front Panel

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

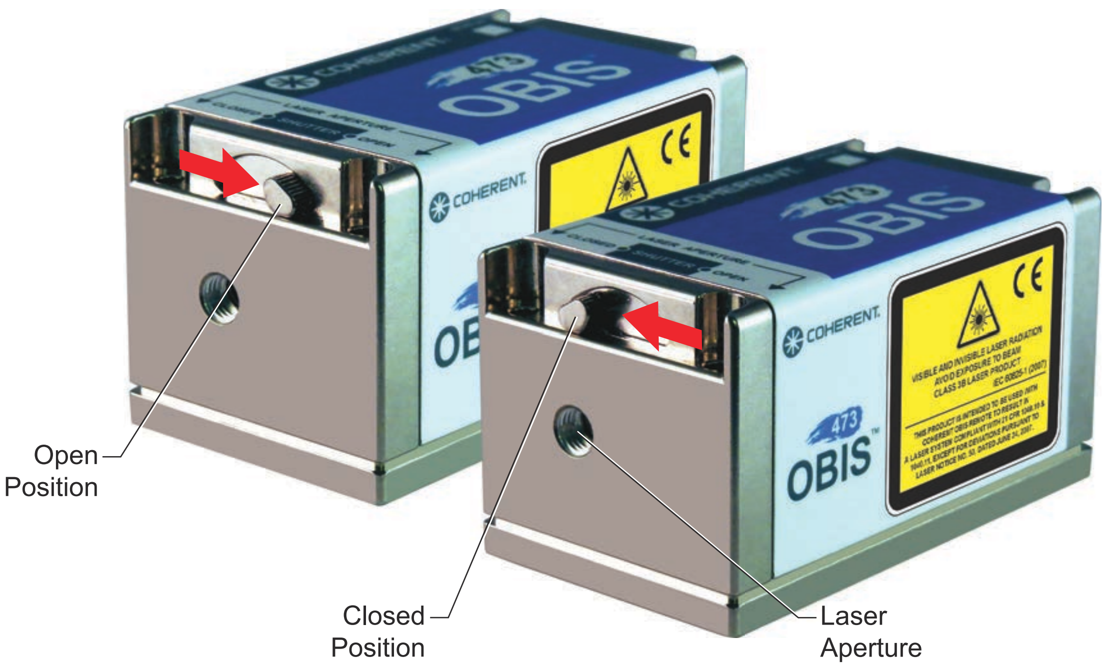


Figure 2-4. OBIS Laser Shutter in Open and Closed Positions

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!

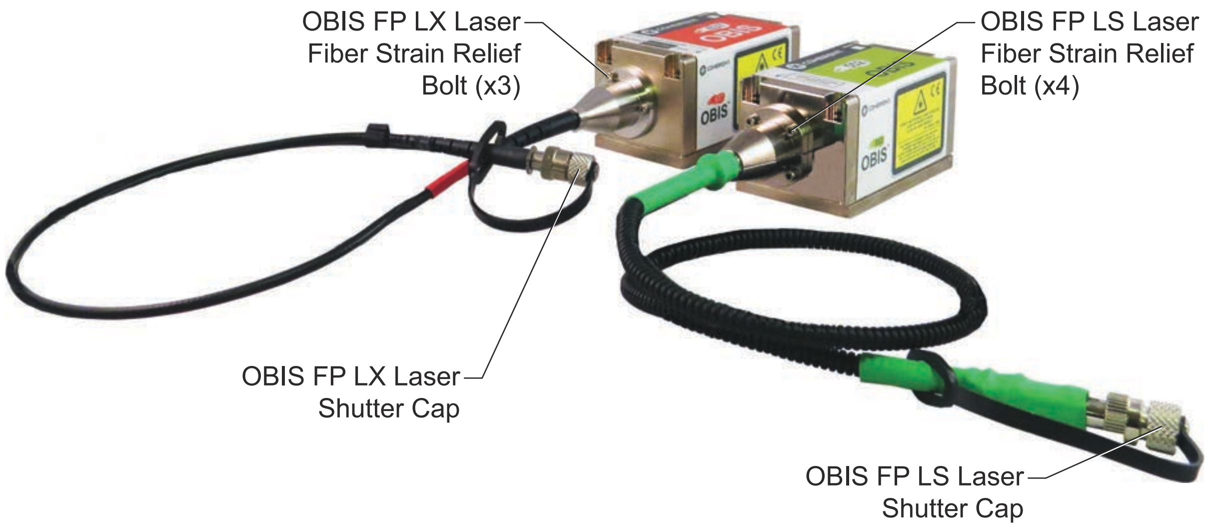


Figure 2-5. OBIS FP Laser

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 640 nm and 660 nm).

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

Back Panel

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

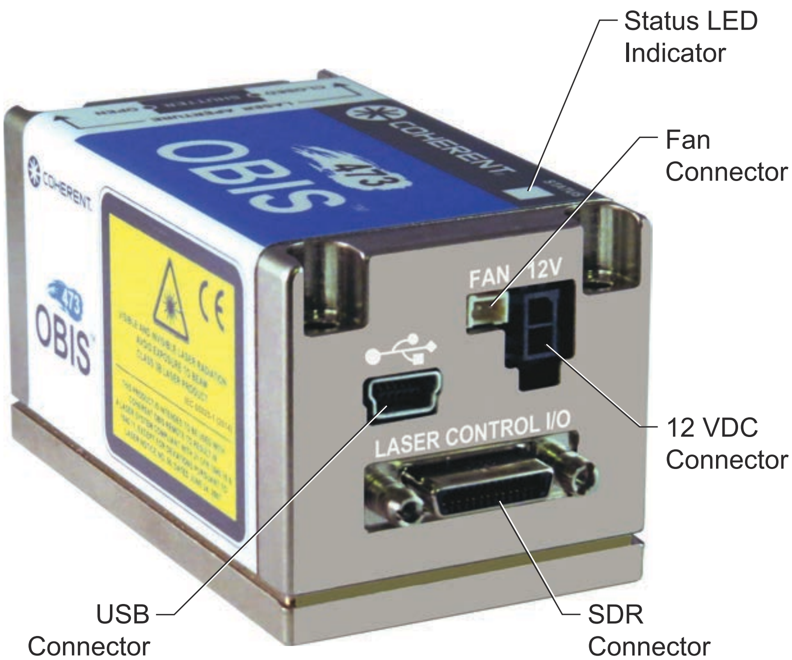


Figure 2-7. Laser Back Panel

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.

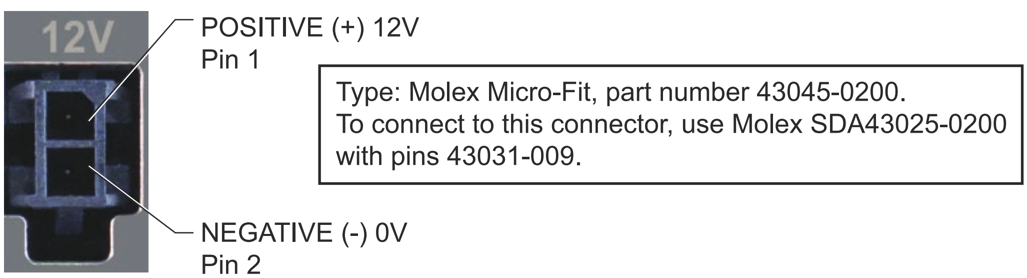


Figure 2-8. 12 VDC Supply Connector Pin Location

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.

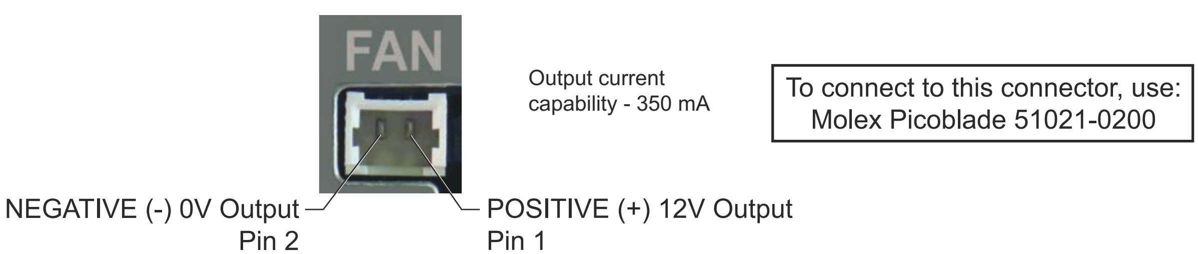


Figure 2-9. Fan Connector Pin Location

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.

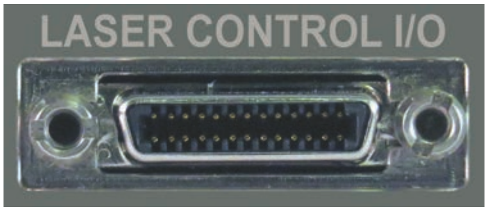


Figure 2-10. SDR Connector

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

Status LED Indicator

The tri-color LED located on the laser (shown in Figure 2-12) indicates the status of the laser.

Refer to Table 2-4 (p. 2-13) for a description of the laser colors and display patterns.

Figure 2-12. Status LED Indicator

Configurations

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 commands.
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.) ***NOTICE!*** **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. Coherent Connection is available on the Coherent OBIS USB memory drive and can also be downloaded here: http://cohrdownloads.blob.core.windows.net/file/Coherent_Connection_4.zip
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!*** **USB does not function in this mode.** NOT RECOMMENDED
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.

Figure 2-13 shows the SDR connector. Use this with the OBIS 1-Laser Remote or Scientific 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.

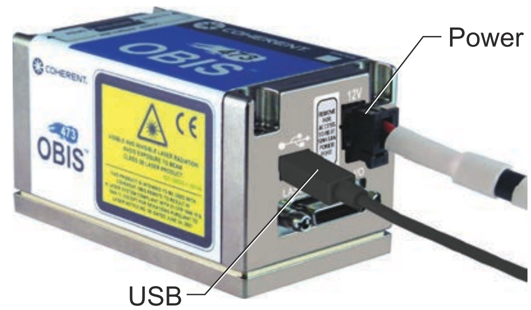


Figure 2-14. Laser System Connections in an OEM Configuration

WARNING!
Do NOT Use the Power Cable and the SDR cable at the same time! The configuration shown in Figure 2-15 is invalid.

Figure 2-15. INVALID Laser System Configuration

OBIS LX 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.

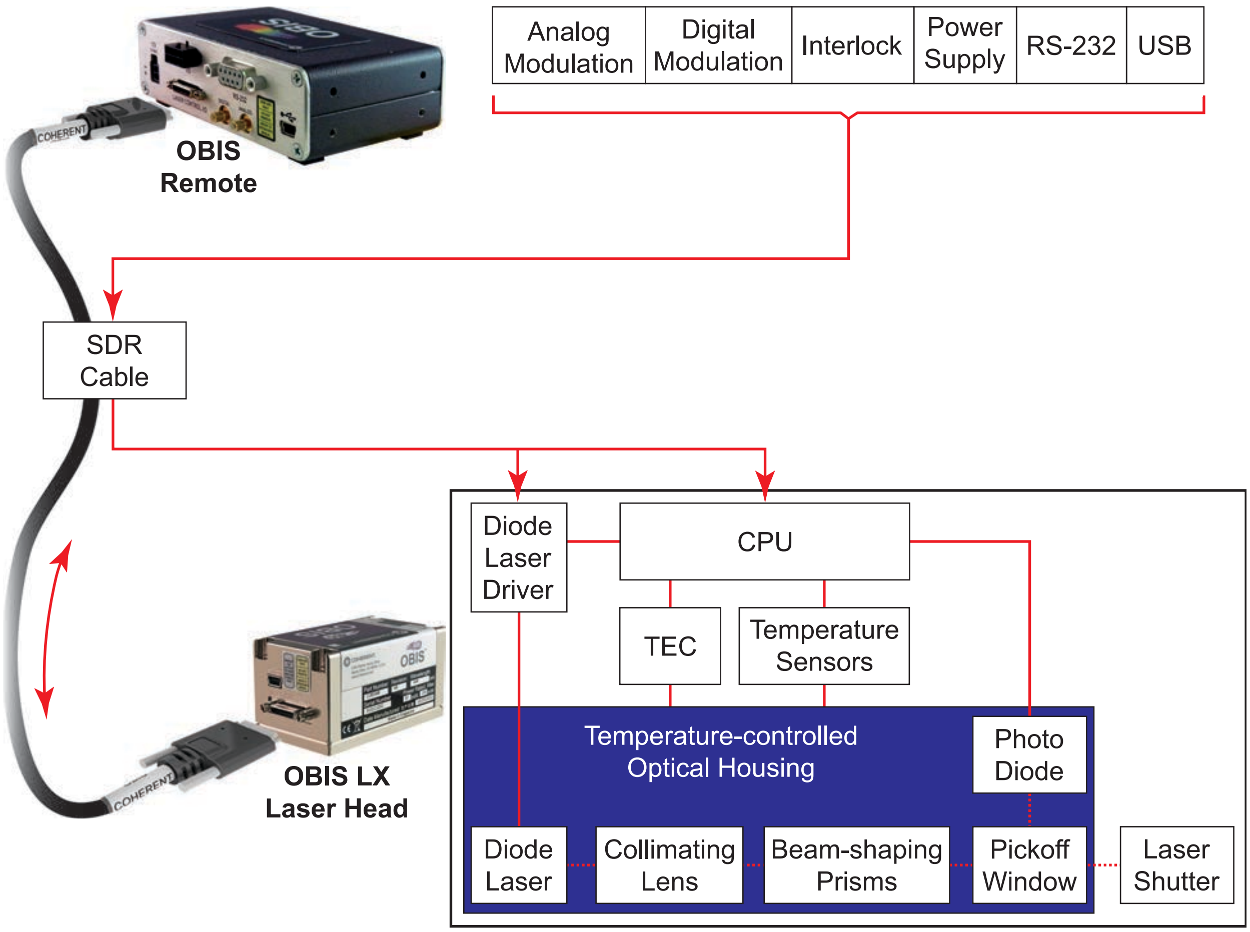


Figure 2-16. OBIS LX Functional Block Diagram

OBIS LS Functional Block Diagram

Figure 2-17 shows the functional block diagram for the OBIS LS laser.

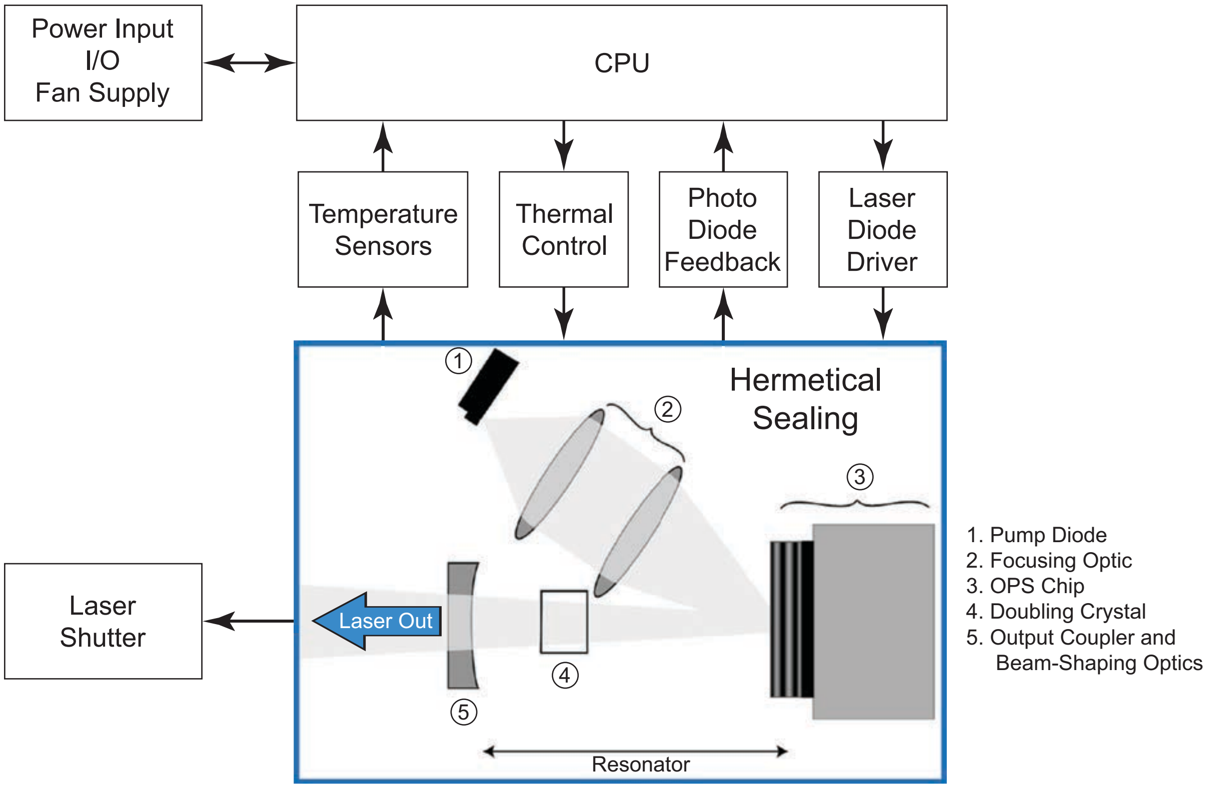


Figure 2-17. OBIS LS Functional Block Diagram

OBIS Laser and Remote Status Indicators

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

- OBIS Laser and OBIS Remote (p. 2-13)
- OBIS 6-Laser Remote (see p. 10-4)
- OBIS Scientific Remote (Table 11-3 on page 11-5)
- OBIS Laser Box (Table 12-4 on page 12-6)

Figure 2-18 shows the location of the LED status indicators on the OBIS Laser and the OBIS Remote:

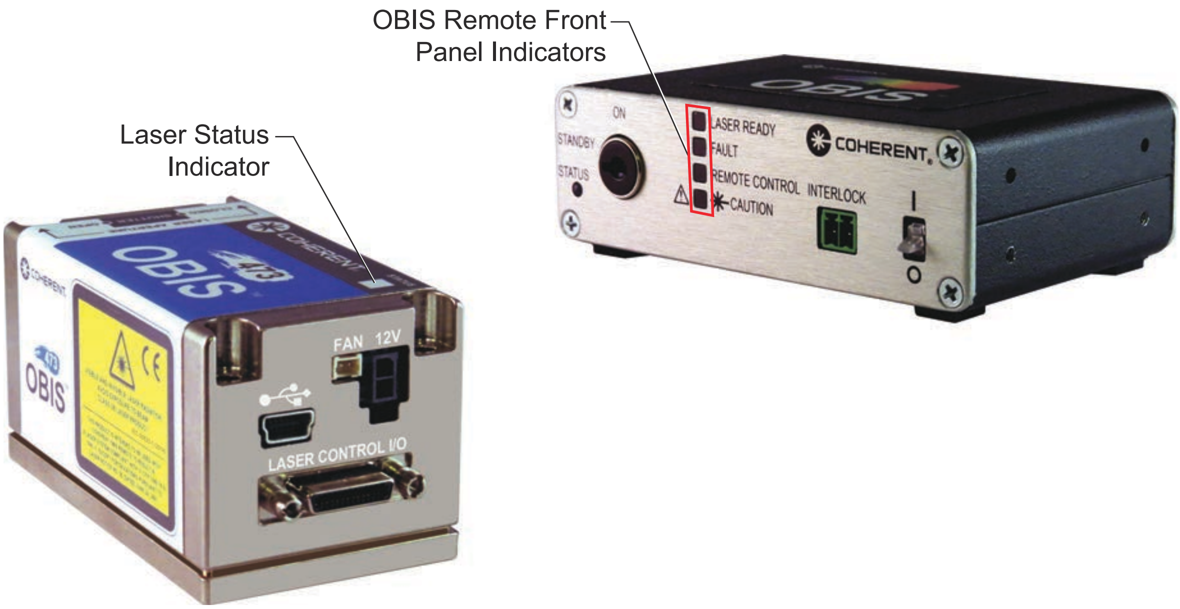


Figure 2-18. Status Indicator Locations

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

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.

Table 2-4. OBIS Laser and OBIS Remote Indicators

<table>
<tr><th rowspan="2">LASER STATUS</th><th rowspan="2">STATUS INDICATOR ON THE LASER</th><th colspan="4">OBIS REMOTE FRONT PANEL INDICATORS</th><th rowspan="2">OBIS Interlock Laser Warning Light[a]</th></tr>
<tr><th>LASER READY</th><th>FAULT</th><th>REMOTE CONTROL</th><th>CAUTION</th></tr>
<tr><td>Fault[b]</td><td>Red</td><td>OFF</td><td>Red</td><td rowspan="6">ON only when USB/RS-232 connected; otherwise, OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>Warm-up</td><td>Flashing green</td><td>Flashing green</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>STANDBY</td><td>Blue</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>CDRH 5-second Delay</td><td>White</td><td>Flashing green</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Laser Emission but not at Set Power Level[c]</td><td>White</td><td>Flashing green</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>Laser Ready[d]</td><td>White</td><td>ON</td><td>OFF</td><td>ON</td><td>ON</td></tr>
</table>

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.

Dimensions for the OBIS LX/LS Lasers

This section provides dimensions for the following lasers, along with links to the Coherent website for more information.

OBIS LX/LS Lasers

Figure 2-19 shows the dimensions for the OBIS LX/LS Lasers. For current drawing dimensions and product details, see:

https://cohrcdn.azureedge.net/assets/drawings/OBISDimensionalDrawing04OCTOBER2011.pdf

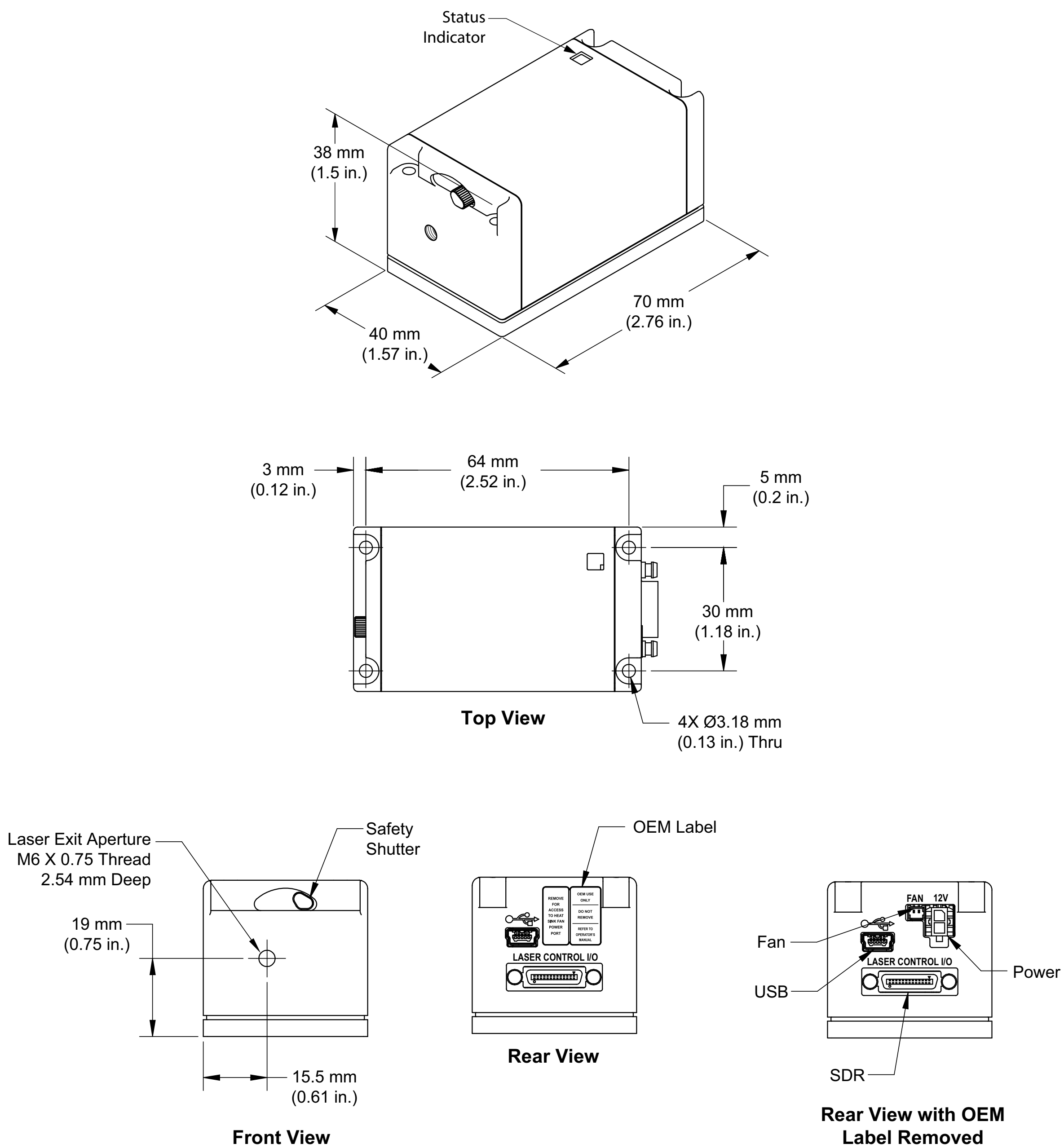


Figure 2-19. OBIS LX/LS Laser Dimensions

OBIS FP LX Laser (Fiber-Pigtailed)

Figure 2-20 shows the dimensions for the OBIS FP (Fiber-Pigtailed) LX laser. For the latest drawing dimensions and product details, see:

https://www.coherent.com/lasers/laser/cw-solid-state-lasers/obis-lasers/obis-fp-fiber-pigtailed

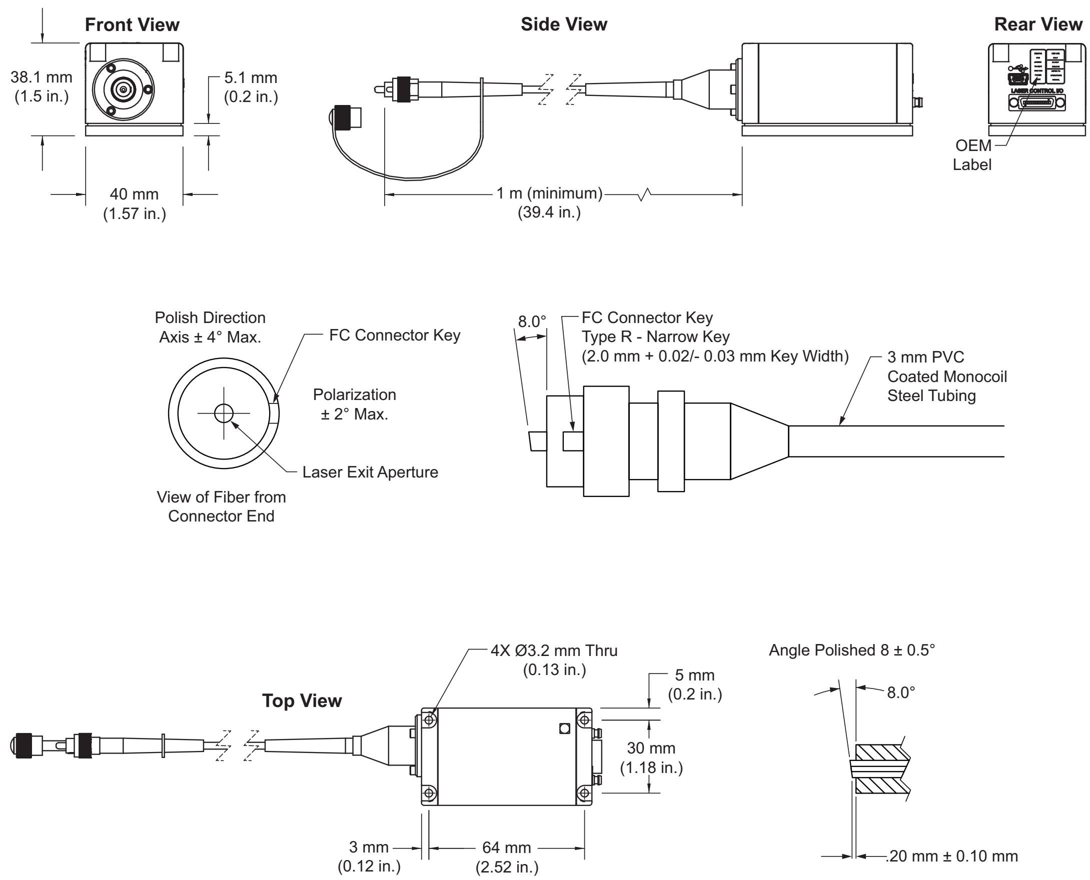


Figure 2-20. OBIS FP LX Laser Dimensions

OBIS FP LS Laser (Fiber-Pigtailed)

Figure 2-21 shows the dimensions for the OBIS FP (Fiber-Pigtailed) LS laser. For the latest drawing dimensions and product details, se:

https://www.coherent.com/lasers/laser/cw-solid-state-lasers/obis-lasers/obis-fp-fiber-pigtailed

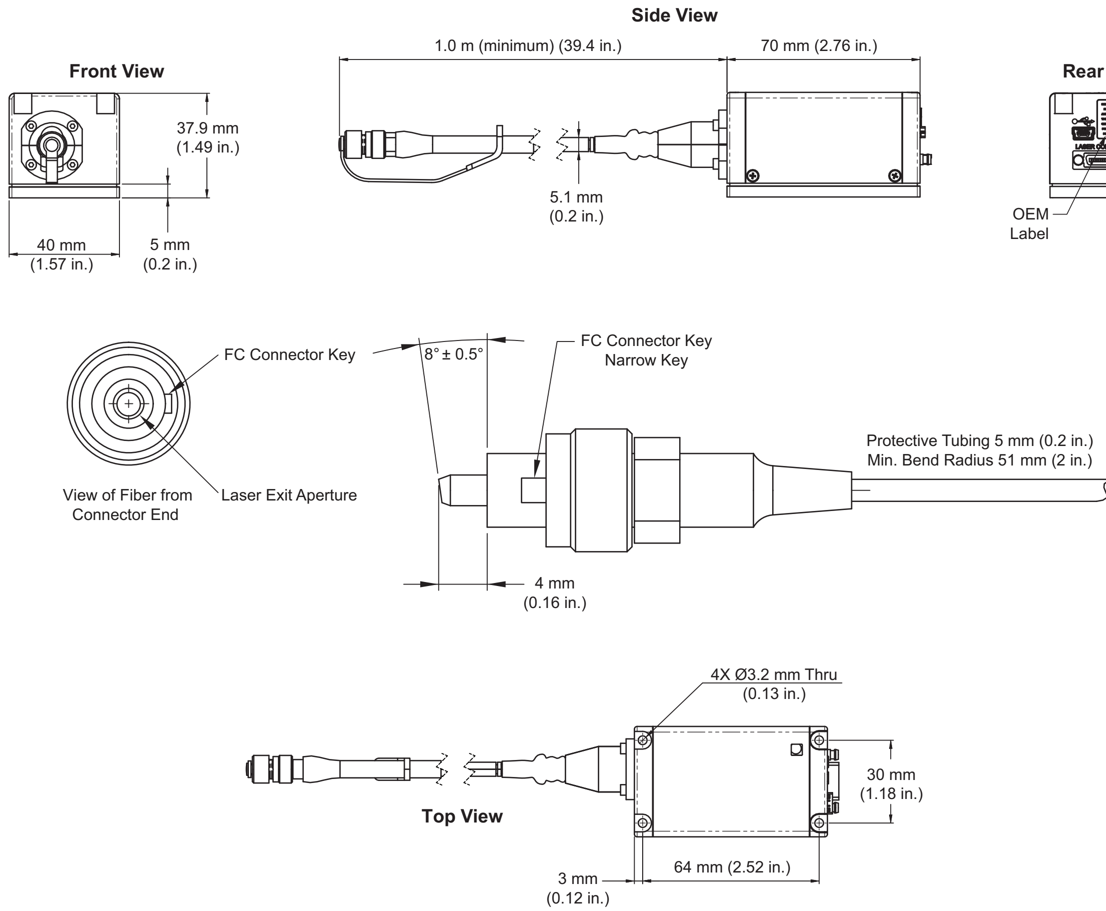


Figure 2-21. OBIS FP LS Laser Dimensions

Heatsink (optional)

OBIS lasers require heatsinking because the base plate of the laser is cooled by conduction.

The optional OBIS heatsink accessory shown in Figure 2-22 is sold separately—see "Appendix B: OBIS Accessories Parts List" (p. B-1).

Figure 2-22. Heatsink (optional)

For OEM integration, refer to “Heatsink Requirement” (p. 6-4) which shows the heat dissipation of the OBIS Laser for given baseplate temperatures.

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

Common Laser Features

The common features of the 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

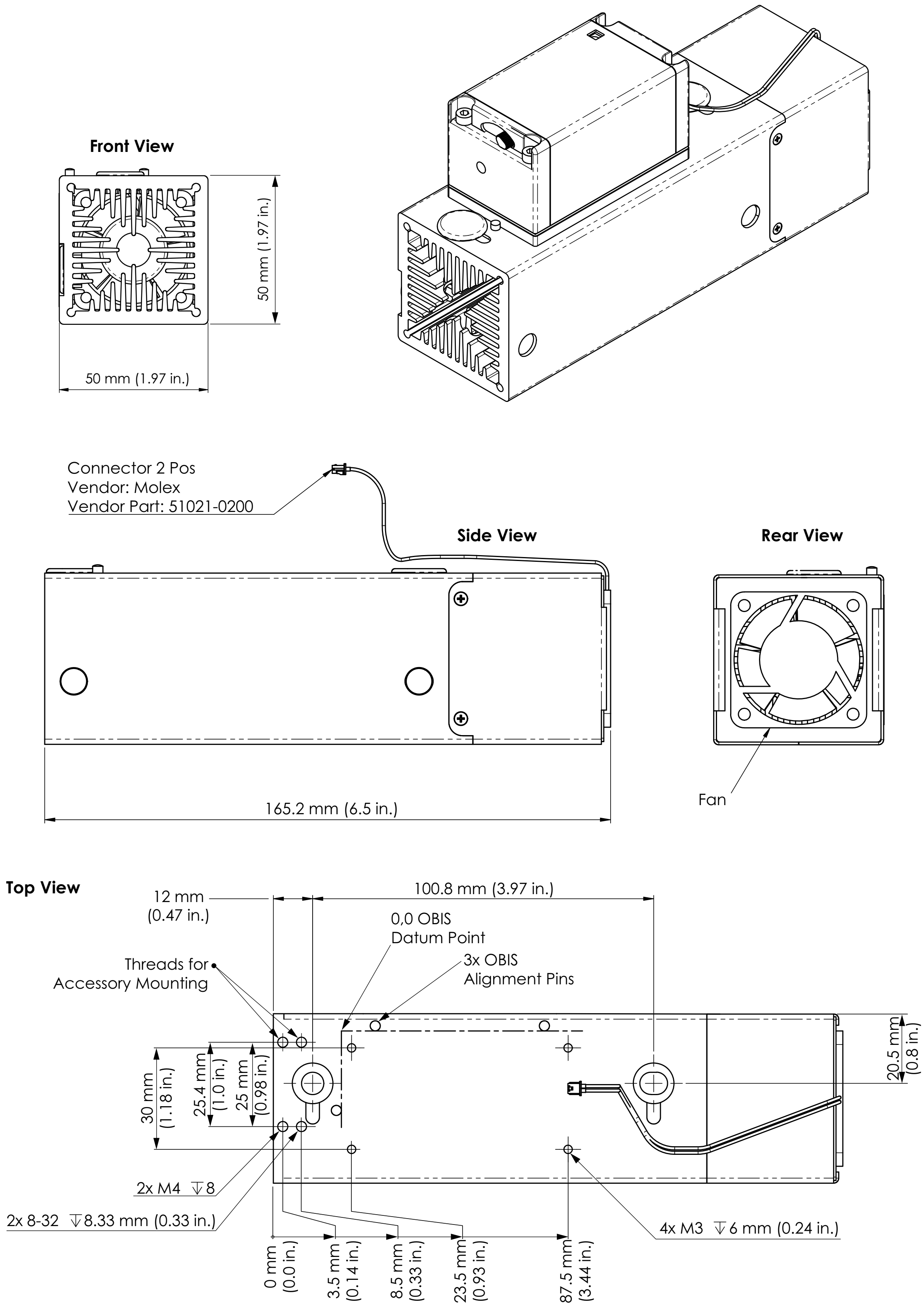


Figure 2-23. Heatsink Dimensions

Power Supply for OBIS Laser or OBIS Remote

The OBIS Laser System includes a power supply, shown in Figure 2-24, that has a power ON indicator. **Note: The power supply is not compatible with OBIS 6-Laser Remote.**

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 of power supplies that look almost the same but may have different output voltages that can damage your laser system.

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

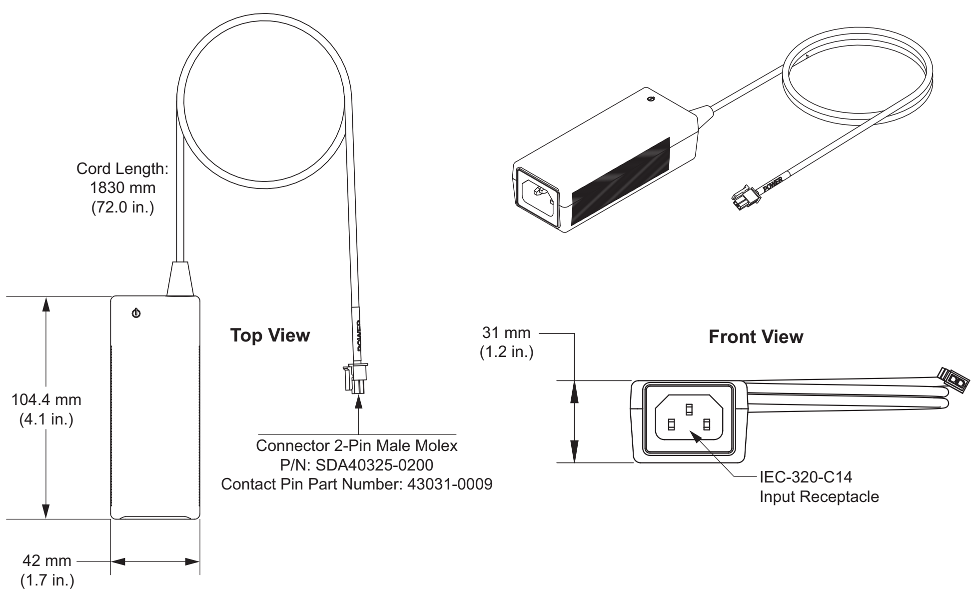


Figure 2-25. OBIS Remote Power Supply Dimensions

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

OBIS Single Laser Remote

The OBIS Single Laser Remote is a compact control box that lets you connect to—and interface with—a single laser. OBIS Remotes are “stackable,” which lets you install several Remotes in a single system.

NOTICE!
To be CDRH compliant, you *must* use an OBIS Remote 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. If Auto Start is disabled (OFF), there is also a 5-second delay added before laser emission.

The modulation SMB connectors are for analog and/or digital modulation. Review Analog Modulation specifications for input requirements.

Front Panel

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

Figure 2-26. OBIS Remote Front Panel

Keyswitch

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

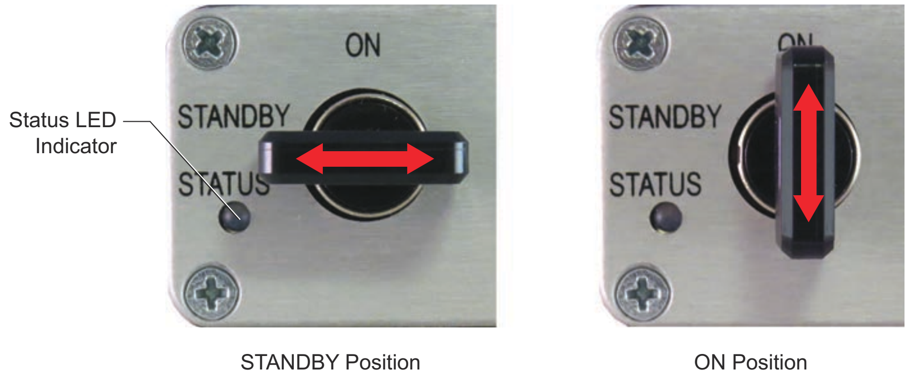


Figure 2-27. OBIS Remote Keyswitch

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

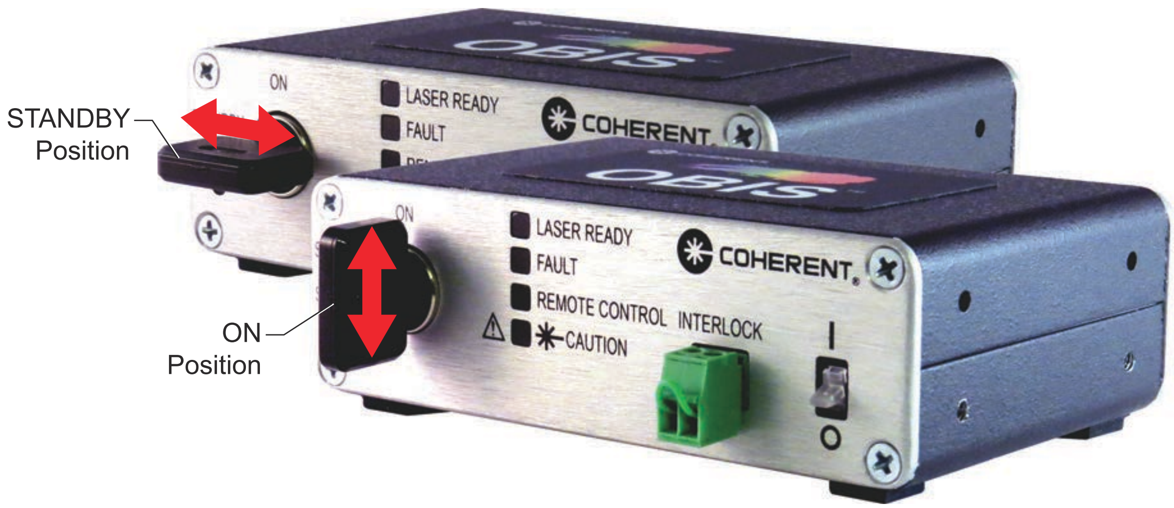


Figure 2-28. OBIS Remote Keyswitch STANDBY and ON Position

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. 2-12) for a complete list of Status states.

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.

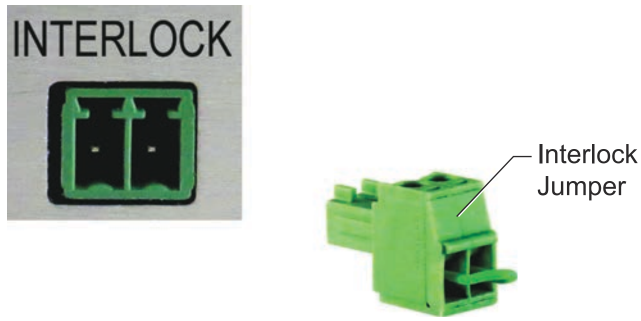


Figure 2-30. OBIS Remote Interlock Jumper

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

Back Panel

The back panel of the OBIS Remote (shown in Figure 2-32) offers the following connectors: Power In, I/O, laser (SDR), Modulation Input, RS-232, and USB. The Auto Start switch is also found on the back panel. These connectors and switches are described next.

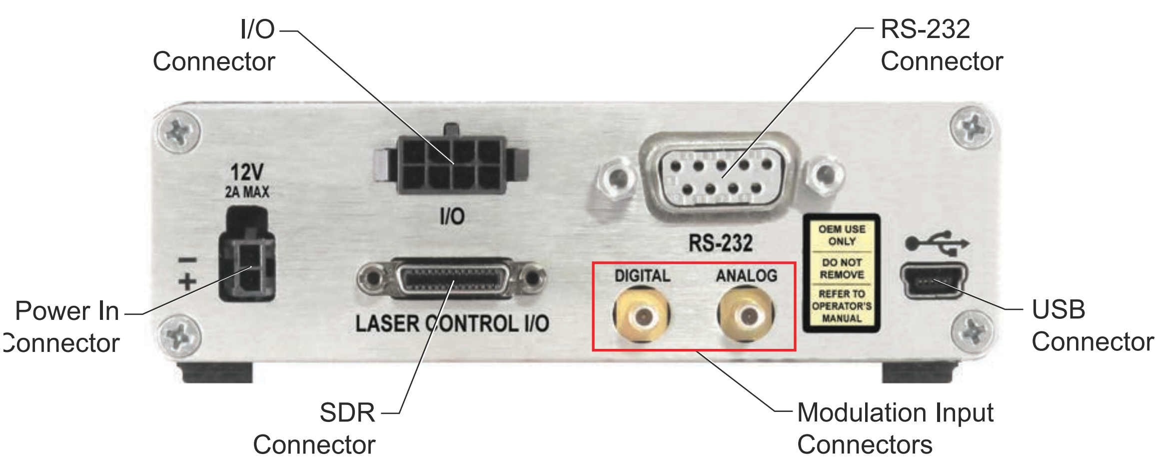


Figure 2-32. OBIS Remote Back Panel

Power In Connector

Power is supplied to the OBIS Remote by a 5.5 mm, 2-pin, male, Molex 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

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

All OBIS Remotes include the power supply. For more information about the power supply, refer to “Power Supply for OBIS Laser or OBIS Remote” (p. 2-19).

I/O Connector

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

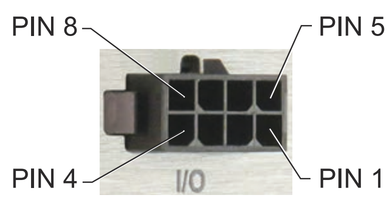


Figure 2-34. Pins on I/O Connector

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

SDR Connector

Use the connector shown in Figure 2-35 to connect a Coherent OBIS SDR cable between the OBIS Remote and the laser. Refer to "Appendix B: OBIS Accessories Parts List" (p. B-1) for ordering information.

Figure 2-35. OBIS Remote SDR Connector

Figure 2-36 shows the pin locations for the OBIS Remote SDR connector:

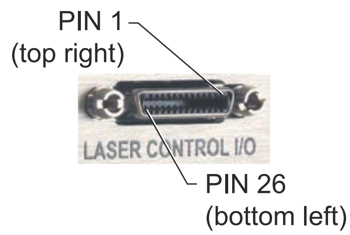


Figure 2-36. Pin Locations for the OBIS Remote SDR Connector

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)

a. DO NOT use a camera link cable, which damages the system.

Modulation Input Connectors

The SMB connectors (one Digital, one Analog) are shown in Figure 2-37. These connect to amplifiers within the OBIS Remote and are converted to Low Voltage Differential Signals (LVDS) to pass through the SDR cable to the laser.

- 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.

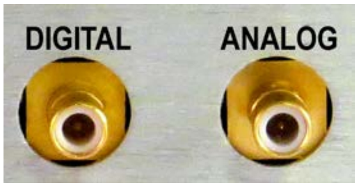


Figure 2-37. OBIS Remote Modulation Input Connectors

RS-232 Connector

Attach an RS-232 cable between this DB9F RS-232 connector (shown in Figure 2-38) and the RS-232 connector on a host computer to send commands to the OBIS Laser. Use a standard straight RS-232 cable. *DO NOT use a Null Modem cable*.

Figure 2-38. 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

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)		

USB Connector

The USB Mini-B connector shown in Figure 2-39 lets you connect 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 2-39. OBIS Remote USB Connector

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 B: OBIS Accessories Parts List” (p. B-1) 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.

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. ***Use only a Coherent OBIS Laser-to-Remote SDR cable—DO NOT use a Camera Link cable.***

Dimensions for the OBIS Remote

This section provides dimensions for the OBIS Remote, both with and without the mounting bracket.

Figure 2-40 shows the dimensions for the standalone OBIS Remote.

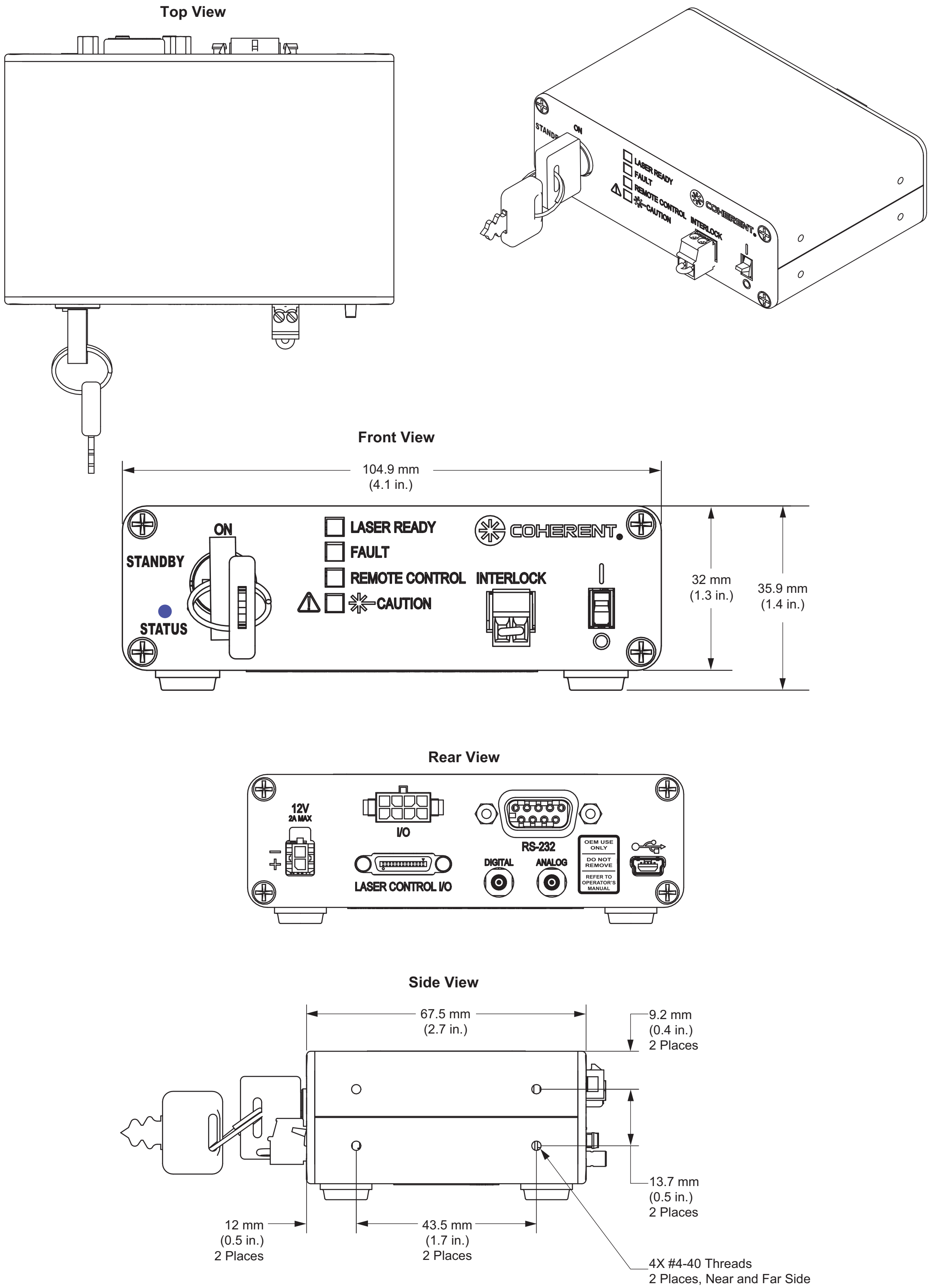


Figure 2-40. OBIS Remote Dimensions (Standalone)

Figure 2-41 shows the dimensions for the OBIS Remote with Mountain Brackets:

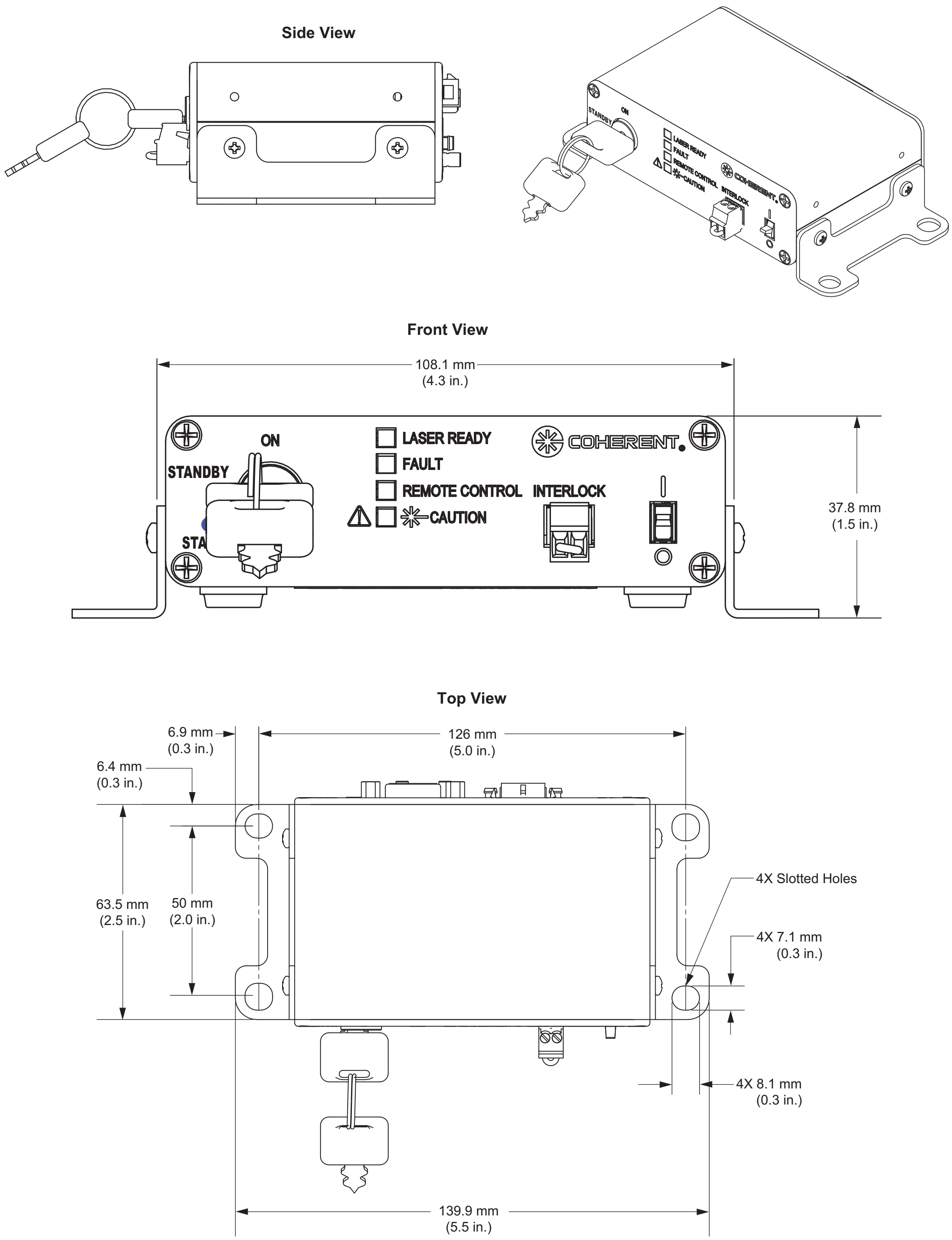


Figure 2-41. OBIS Remote (with Mounting Brackets) Dimensions

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 2.5V, capable of processing digital signals beyond 150 MHz. One analog: Selectable input impedance of either 50 ohms or 2K ohms. Signal levels from 0 to 5V, signal bandwidths beyond 1 MHz.	
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	
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		
1. Laser Fault Output Signal	0V - no fault 3.3V - fault	< 0.5V: laser OK, > 2.5V: laser error Output impedance is < 200 Ohm
2. 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
3. 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	
4. Power Monitor Signal	0 to 2V represents 0 to 110% of the Laser Output power	
5. Slow Digital Modulation Input Signal	0 to 3.3V TTL logic level 5 kOhm input impedance 1 MHz maximum speed	
6. 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	

Section Three: Installation of the OBIS Laser System

The procedure in this section describes how to connect the OBIS Laser and OBIS Remote. For information on how to install the laser *without* the OBIS Remote, refer to "OBIS Communications through a Terminal Program" (p. 6-5).

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. For information, refer to "OBIS Communications through a Terminal Program" (p. 6-5).

NOTICE!
To be CDRH compliant, you *must* use an OBIS Remote with the laser—the laser alone is *not* CDRH compliant.

The installation procedure includes the following steps:

Step 1: Install the heatsink (optional) (p. 3-1)

Step 2: Mount the laser (p. 3-4)

Step 3: Add fan power (optional) (p. 3-7)

Step 4: Connect the SDR cable (p. 3-7)

Step 5: Connect power (p. 3-8)

Step 6: Connect the interlock jumper (p. 3-8)

Step 7: Connect USB/RS-232 (optional) (p. 3-9)

Step 8: Clean the OBIS fiber tip (OBIS fiber-pigtailed lasers only) (p. 3-10)

Step 1: Install the Heatsink (optional)

The Coherent OBIS heatsink is the result of important design research and testing. The mounting of any laser is important in increasing the stability of the beam over time and temperature. The heatsink provides correct thermal dissipation and mechanical positioning.

1. Remove the two heatsink plugs to access the mounting holes.
   Note: The plate not included.

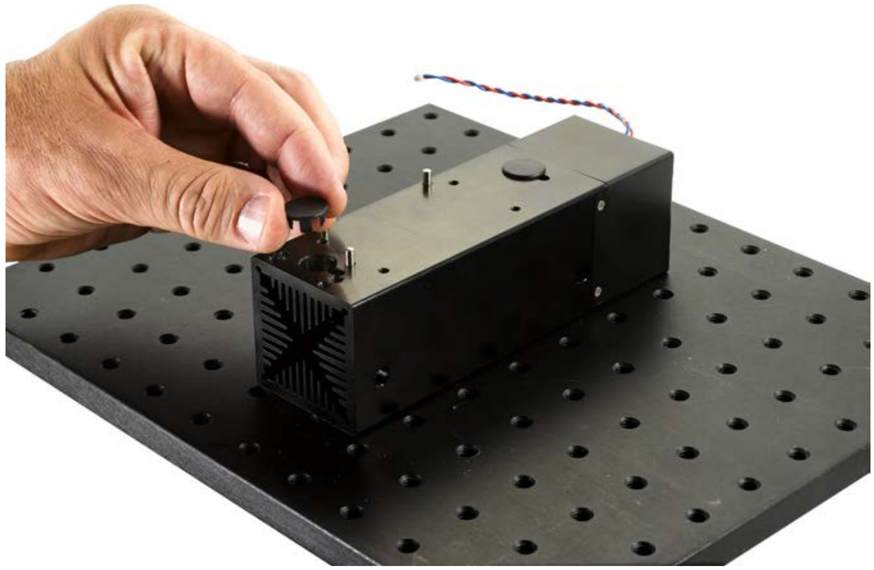


Figure 3-1. Remove the Heatsink Plugs

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

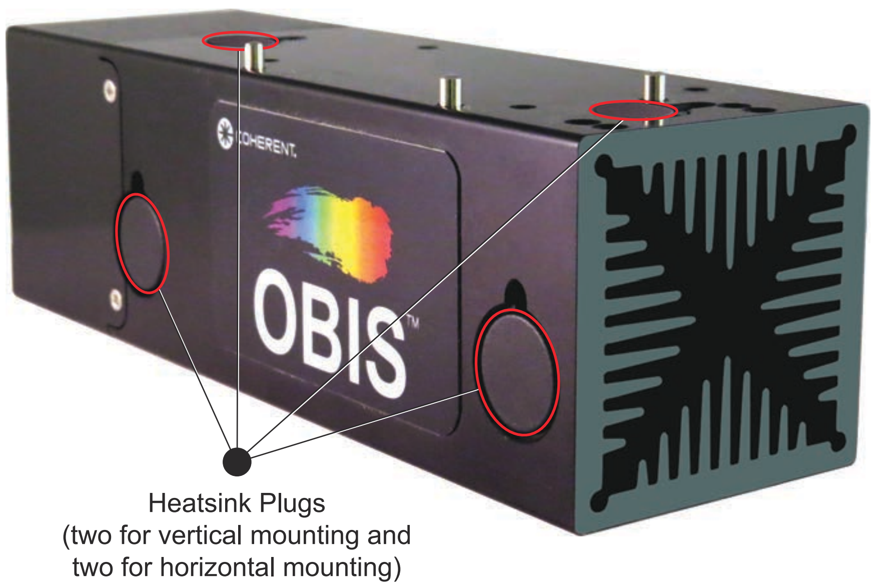


Figure 3-2. Heatsink Plug Locations

2. Fasten the heatsink to the desired location using 1/4-20 x 0.625” L or M6x16 mm mounting screws. Make sure the ends of the heatsink remain clear for correct air flow.

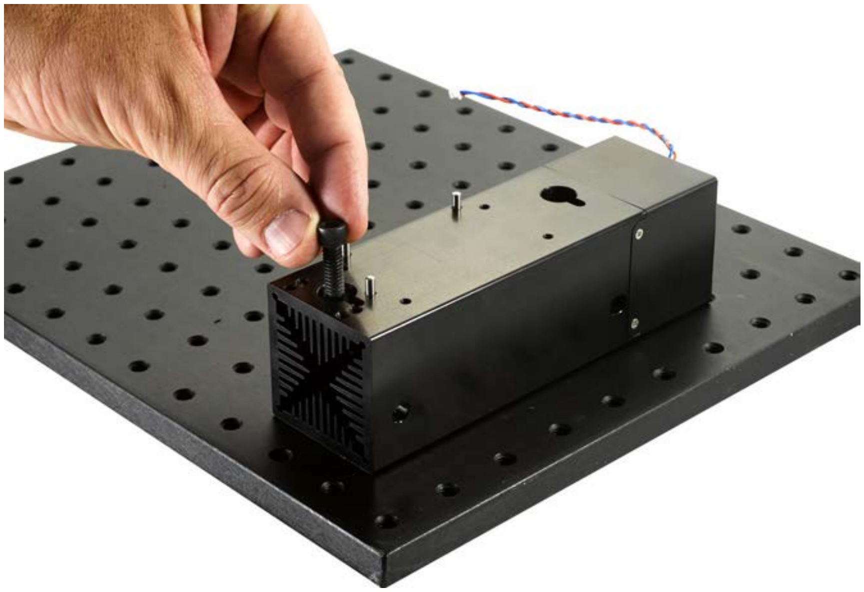


Figure 3-3. Bolt the Heatsink to the Desired Location

3. Torque the two mounting screws to 4.5 Nm (635 oz in).

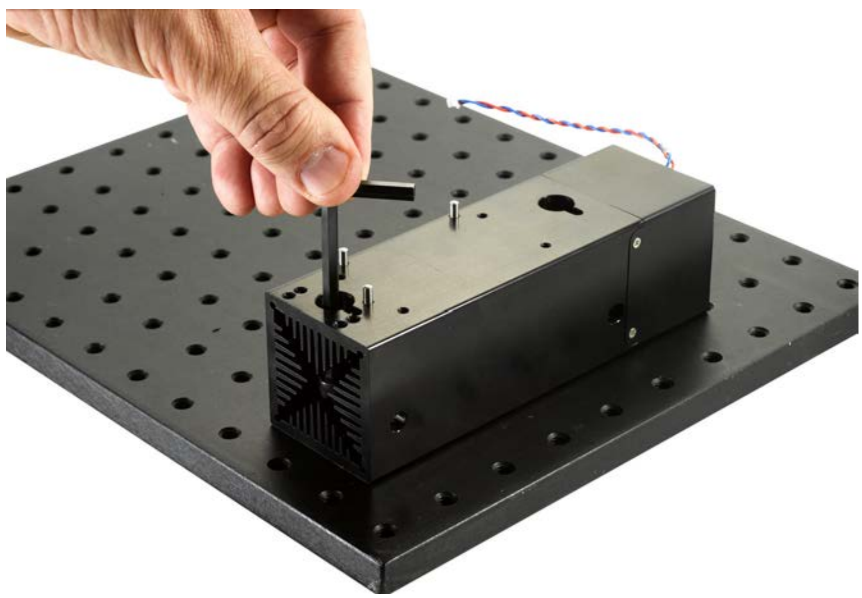


Figure 3-4. Torque the Mounting Screws

4. Replace the heatsink plugs to the original position in the heatsink. *This step is mandatory to ensure efficient cooling.*

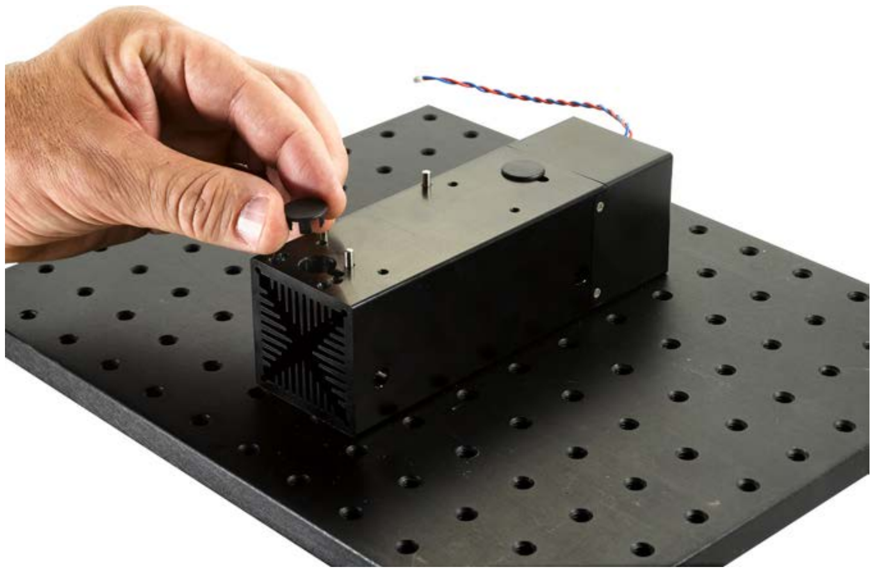


Figure 3-5. Replace the Heatsink Plugs

Step 2: Mount the Laser

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.

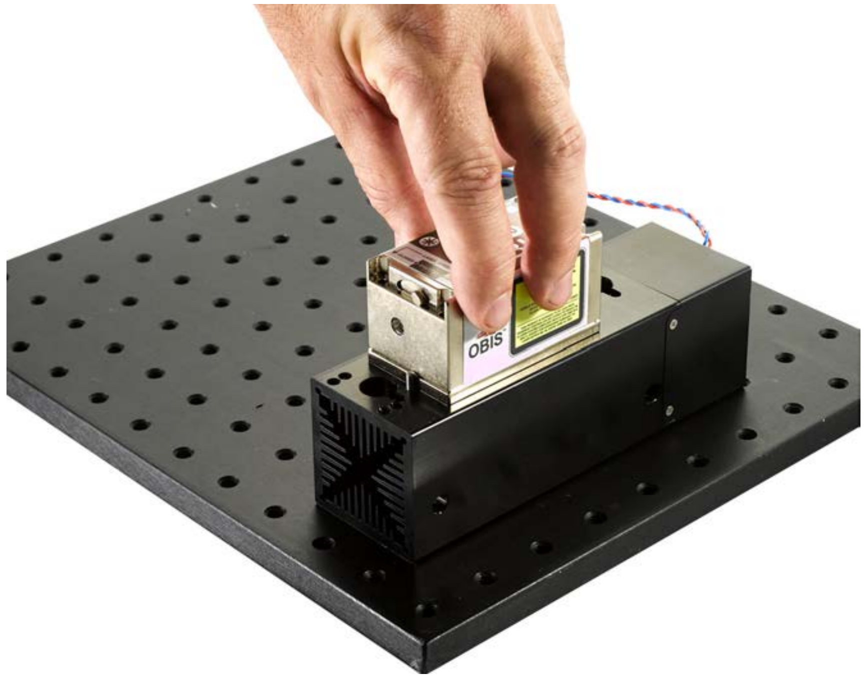


Figure 3-7. Align the Laser to the Heatsink

Figure 3-8. Install the Mounting Screws and Washers

3. 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.).

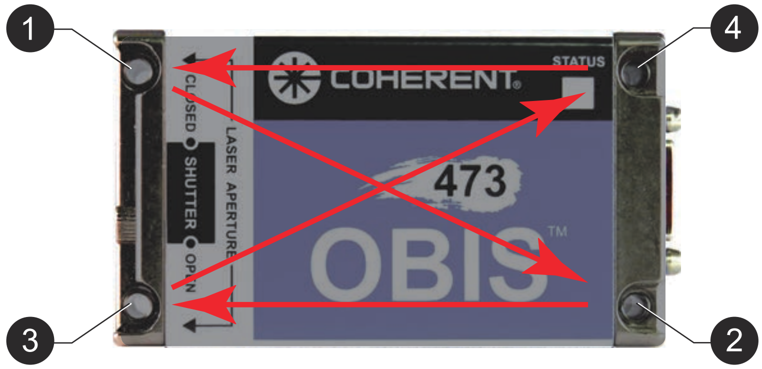


Figure 3-9. Tightening Pattern for Mounting the OBIS Laser

Figure 3-10. Tighten the Mounting Screws

Step 3:Add Fan Power (optional)

If fan operation is required, remove the gray label that covers the OBIS Fan connector. *DO NOT remove the yellow label next to it*.

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

Connect the heatsink fan cable to the Fan connector on the OBIS. The fan cable supplies power to the heatsink fan.

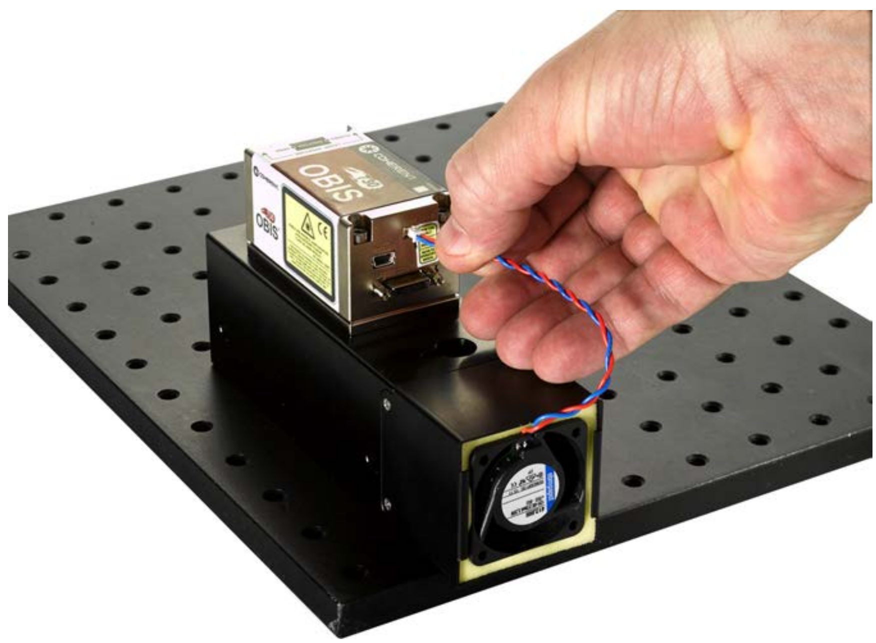


Figure 3-12. Connect the Fan Cable to the OBIS Fan Connector

Step 4: Connect the SDR Cable

Connect the SDR connector to the laser and the OBIS Remote, as shown in Figure 3-13.

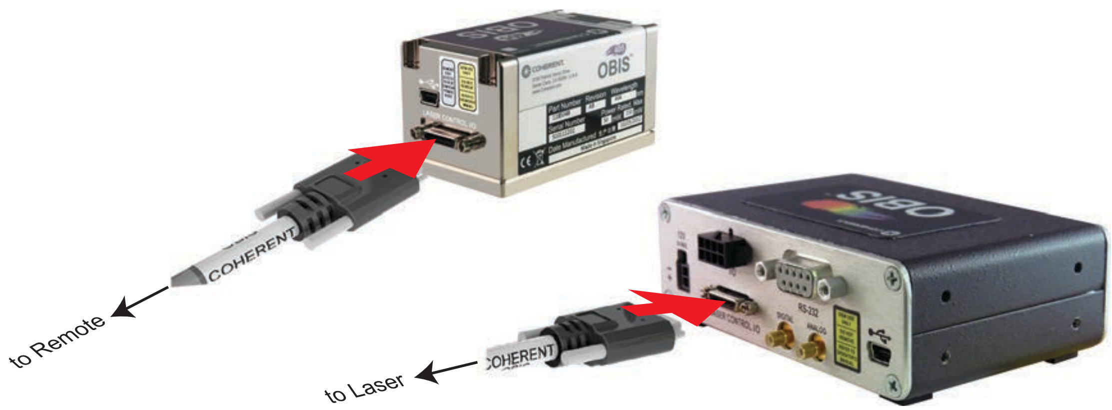


Figure 3-13. Connect the SDR Cable

Step 5: Connect Power

Connect the 12 VDC power to the OBIS Remote, as shown in Figure 3-14.

Figure 3-14. 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 Remote" (p. 2-19).

Step 6: Connect the Interlock Jumper

Connect the interlock jumper as shown in Figure 3-15. For interlock details and specifications, refer to "Interlock Control" (p. 2-25).

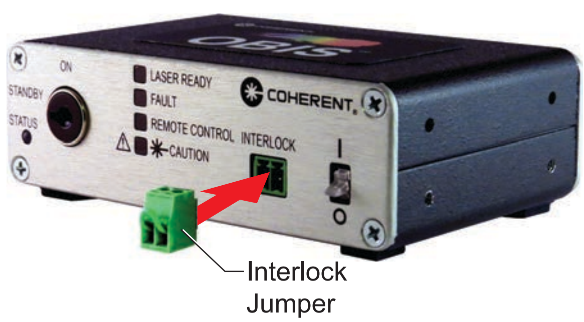


Figure 3-15. Connect the Interlock Jumper

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 note, below). For details about how to enable this feature, refer to “Connect USB/RS-232” (p. 5-2).

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 support RS-232, USB, and Ethernet.

This completes the OBIS Laser installation with the OBIS Remote.

If you have an OBIS fiber-pigtailed laser, continue with the following instructions for additional installation steps.

OBIS Fiber Pigtailed (OBIS FP) Lasers

The OBIS Fiber Pigtailed (OBIS FP) suite of lasers delivers the simplicity of a plug-and-play system. The fiber pigtail termination is complete with a FC/APC connector. The OBIS FP lasers offer superior performance, reliability, and hands-free operation. These lasers combine single-mode polarization-maintaining fiber with an FC/APC connector for a high-quality low-noise laser beam output. They utilize proprietary fiber technology to provide superior lifetimes, and permanent fiber attachments for guaranteed power over time.

For OBIS FP 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.

Figure 3-16. OBIS FP Laser

Step 8: Clean the OBIS Fiber Tip

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

Clean the Fiber connector to prevent optical degradation and optical or mechanical damage. Also, install the connector in a dust-free and contamination-free environment when running the laser in your application. It is important that fiber connectors are inspected and cleaned before mating. The information in this section describes how to do that.

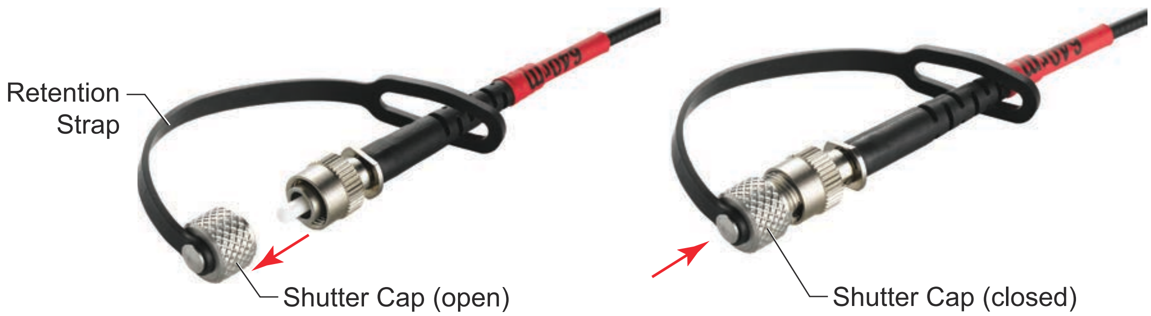


Figure 3-17. OBIS FP Shutter Cap in Open and Closed Position

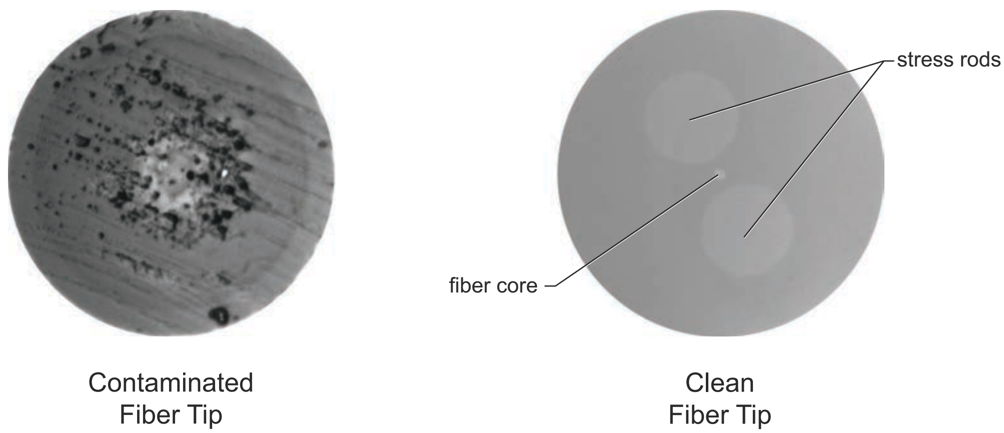


Figure 3-18. Example of Contaminated and Clean SM Fiber Tips

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 human 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. This burn can damage the optical surface so that it cannot be cleaned.

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

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

WARNING!
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.

WARNING!
Never look into a fiber while the laser is in the ON position.

WARNING!
Never connect a fiber to a fiberscope while the laser is in the ON position.

WARNING!
Always turn off the laser before you inspect the fiber tip.

CAUTION!
Follow all safety instructions when using isopropyl/methanol alcohol (used for wet cleaning of the fiber tip). If you do not have a copy of the safety instructions for using alcohol, contact your vendor before following the cleaning information described in this document.

NOTICE!
Always inspect and clean the connectors before you make a connection.

NOTICE!
Never touch the tip of the fiber connectors.

NOTICE!
Never use alcohol or wet cleaning without ensuring a way that does not leave residue on the fiber tip.

General Cleaning Process

1. Inspect the fiber tip with a fiberscope or microscope. If the tip is dirty, use the dry cleaning technique (p. 3-14) to clean it.
2. Re-inspect the fiber tip. If the connector is still dirty, repeat the dry cleaning technique (p. 3-14) a second time.
3. Inspect the fiber tip. If the connector is still contaminated, clean it with the wet cleaning technique (p. 3-15).
4. Inspect the fiber tip again. If the contaminate is still present, repeat the wet cleaning process until the fiber tip is clean.
5. If the fiber tip is still contaminated after several cleaning attempts using the wet cleaning technique, call the Coherent Technical Support Hotline:

   1.800.367.7890 (U.S.)

   1.408.764.4557 (outside the U.S.)

Fiber Tip Inspection

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 for inspecting optical fibers.

The scope should provide at least 200x total magnification.

A specific adapter is needed for the FC/APC (Fiber Connector/Angled Physical Contact) to properly inspect the fiber tip.

Figure 3-19 provides examples of these tools.

FIBER OPTIC SCOPE	DESKTOP VIDEO FIBER INSPECTION MICROSCOPE	FIS FIBER OPTIC MICROSCOPE ADAPTERS
		
P/N FS200	**P/N F1VM400USB**	**P/N F1VSAPC25**

Figure 3-19. Examples of Fiber Tip Inspection Tools

To inspect the connector:

1. Make sure that the laser is turned off before starting the inspection.
2. Put the applicable inspection adapter or probe on your equipment.
3. Unscrew and remove the fiber shutter cap.
4. Insert the Fiber connector into the fiberscope adapter and adjust the focus ring so that you see a clear fiber tip image.
5. Clean the fiber tip and re-inspect, as necessary. Refer to the “General Cleaning Process” (p. 3-12) 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.

Fiber Tip Cleaning Techniques

There are different cleaning methods.

IMPORTANT!
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.

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 shown in Figure 3-20:

OPTIPOP R, P/N ATC-RE-02

http://www.ntt-at.com/product/optipop/

CLETOP-S TYPE A, P/N 14110501

http://www.cletop.com/html/products.html

Figure 3-20. Recommended Cartridge Cleaning Tools

To use the dry cleaning technique:

1. Make sure that the laser is turned off before you start the inspection.
2. Unscrew and remove the fiber shutter cap.
3. Inspect the connector with a fiberscope. Refer to the "Fiber Tip Inspection" (p. 3-13).
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.
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.

CAUTION!
Scrubbing the fiber against the fabric or cleaning over the same surface more than once can contaminate or damage the connector.

8. Repeat steps 6 and 7 (above), using slot 2 instead of slot 1.
9. Release the thumb lever to close the cleaning window.
10. Inspect the connector with the fiberscope. Refer to “Fiber Tip Inspection” (p. 3-13).
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 (explained next).

Wet Cleaning Technique

If it wasn't possible to completely remove the contamination by using the Dry Cleaning Technique:

1. Press down and hold the thumb lever of the cartridge cleaning tool. The shutter will slide back and expose a new cleaning area.
2. *Carefully* drop 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.

NOTICE!
Scrubbing the fiber against the fabric or cleaning over the same surface more than once can contaminate or damage the connector.

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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,” which begin on p. 3-14.

SECTION FOUR: OPERATION OF THE OBIS LASER SYSTEM

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

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. For a short video presentation on the OBIS LX/LS Operating Modes, go to:

https://www.youtube.com/watch?v=_3NCbCG9e7w

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 “Section One: Laser Safety” (p. 1-1) for laser safety information.
2. The laser is mounted with the correct heatsink and torque specifications—refer to “Step 1: Install the Heatsink (optional)” (p. 3-1) for heatsink and torque requirements.
3. The SDR interface cable is connected between the laser and the OBIS Remote.
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).

NOTICE!
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 D: Back Reflection” (p. D-1) for more information.

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. Turn the OBIS Remote keyswitch 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.

The OBIS Laser System offers the following operating modes:

Continuous Wave (CW)

- Constant power (p. 4-3)
- Constant current (*LX version only*) (p. 4-4)
- Power control through analog modulation (p. 4-5)

Pulsed

- Analog modulation (Analog:Power for OBIS LX) (p. 4-7)
- Digital modulation (p. 4-13)
- Digital current (*LX version only*) (p. 4-15)
- Mixed modulation (p. 4-16)

There is a trade-off between power and current modes.

- Power modes are more accurate, with small modulation overshoots, but are slower to modulate.
- Current modes, available only with OBIS LX, have a larger overshoot but allow faster modulation.

Table 4-1 lists the various modes for OBIS LX and OBIS LS lasers.

Table 4-1. 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

CW 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.

Select the operating mode for OBIS LX and LS lasers from the Advanced tab in the Coherent Connection user interface. Figure 4-1 shows the menu options for both the OBIS LX and the OBIS LX lasers.

OBIS LX OBIS LS

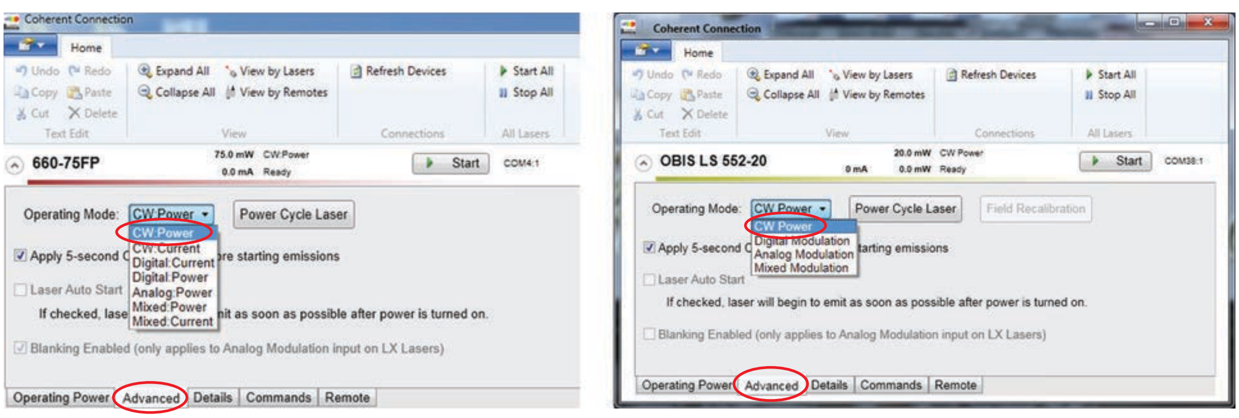


Figure 4-1. Select Operating Mode

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. 4-4) 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 4-2, use the Coherent Connection software to either:

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

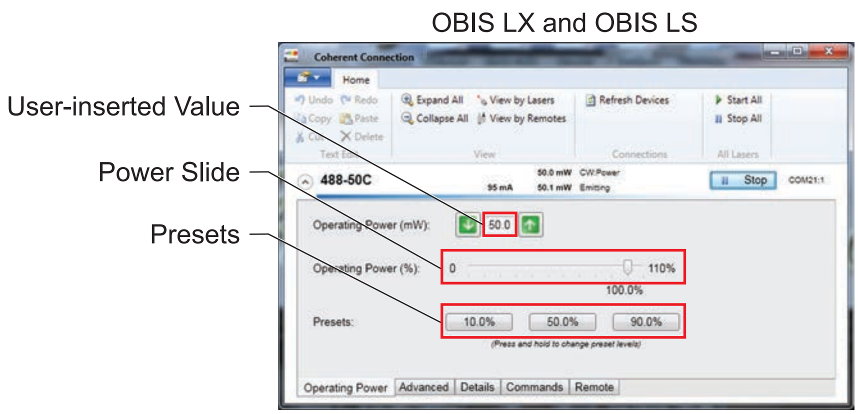


Figure 4-2. Select Output Power Level

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. 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 4-3.

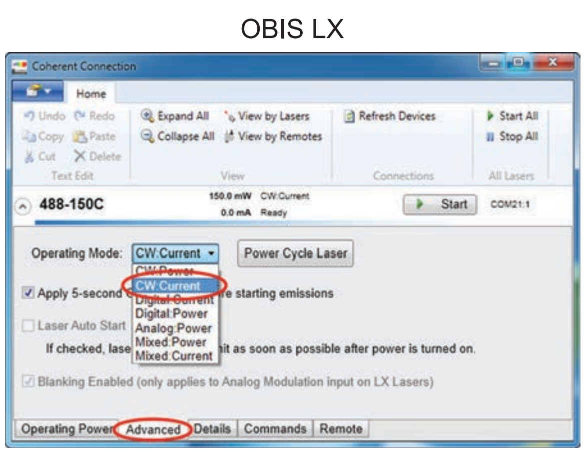


Figure 4-3. Select CW:Current Mode

2. Click the **Start** button. The laser will turn ON after a 5-second delay.
3. With the Coherent Connection software, set the laser output power by doing one of the following:
   - Moving the power slide control, or
   - Selecting one of the three power preset buttons, or
   - Typing in a value.

For more information, see “Calibration Command for OBIS LX” (p. 4-18).

CW Operation Constant Current—Field Calibration (OBIS LX only)

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

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 4-4.

OBIS LX

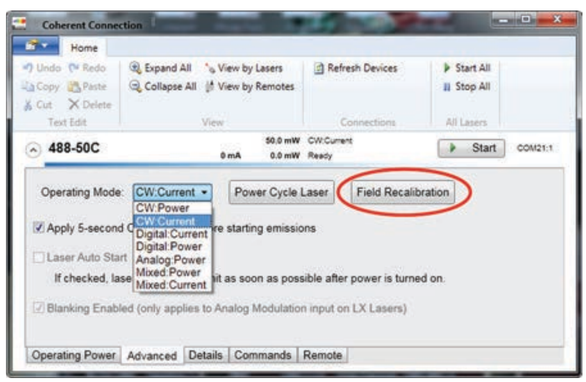


Figure 4-4. Field Calibration Button

If you are using a terminal program, refer to “OBIS Communications through a Terminal Program” (p. 6-5).

CW Power Control through 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 4-5, select:
   - OBIS LX: *Analog:Power*
   - OBIS LS: *Analog Modulation*

OBIS LX OBIS LS

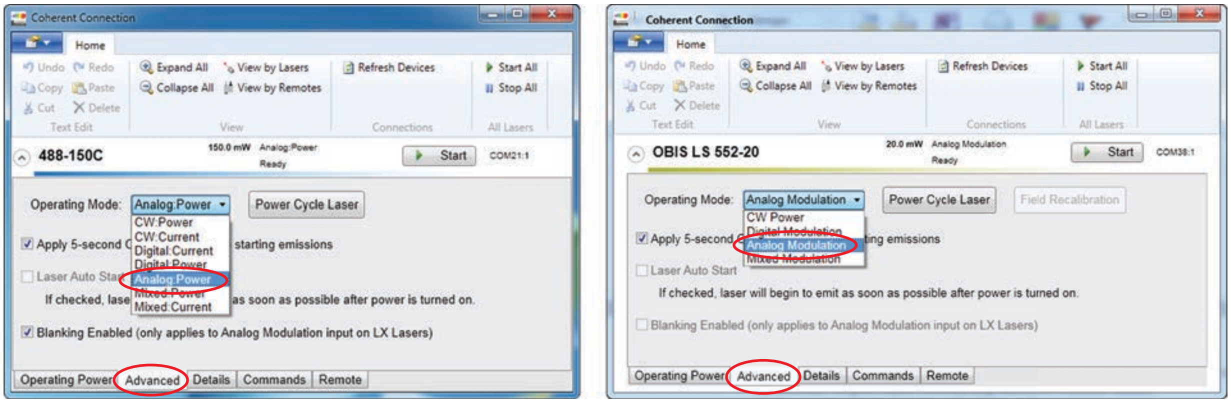


Figure 4-5. Power Control through Analog Modulation

3. Select the Analog Modulation Impedance (*50 Ohms* or *2000 Ohms*) from the Remote tab. This selects the input impedance of the remote.

OBIS LX and OBIS LS

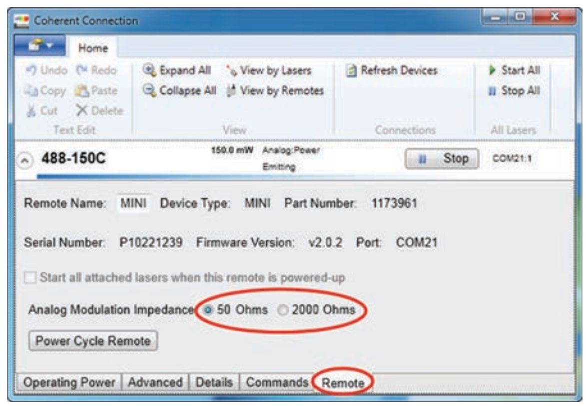


Figure 4-6. Select Impedance

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.

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), seen in these short video presentations:

Table 4-2. Video Presentations about OBIS Modulation Modes

MODE	GO TO
OBIS LX/LS Analog Modulation Mode	https://www.youtube.com/watch?v=8atvlefA4ak
OBIS LX/LS Digital Modulation Mode	https://www.youtube.com/watch?v=1-dibdzFDyk
OBIS LX/LS Mixed Analog and Digital Modulation Mode	https://www.youtube.com/watch?v=DDprnVZPTvM

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 through a Terminal Program” (p. 6-5).

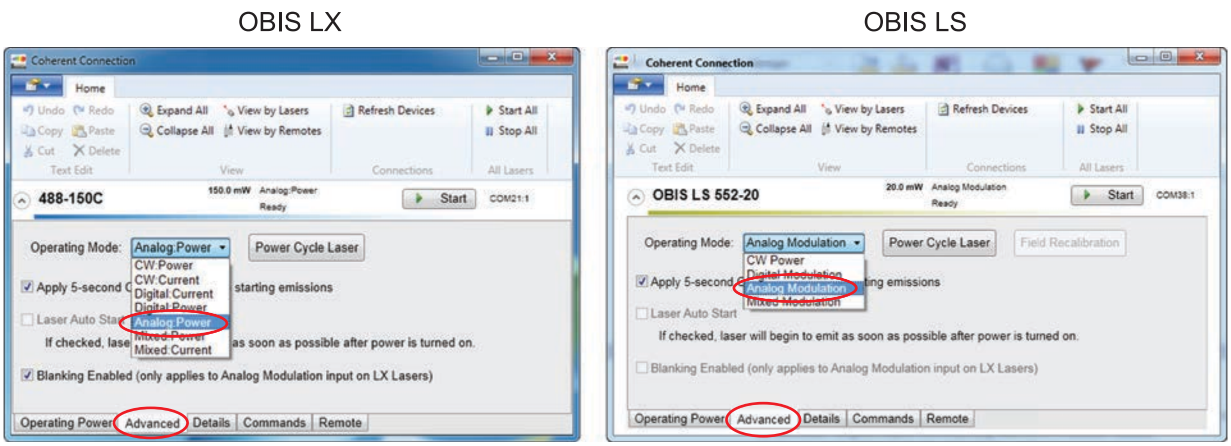


Figure 4-7. Select Analog Modulation

Modulation signals are connected to the back of the OBIS Remote through the SMB connectors, shown in Figure 4-8. There are separate Modulation Input connectors for:

- Analog modulation
- Digital modulation.

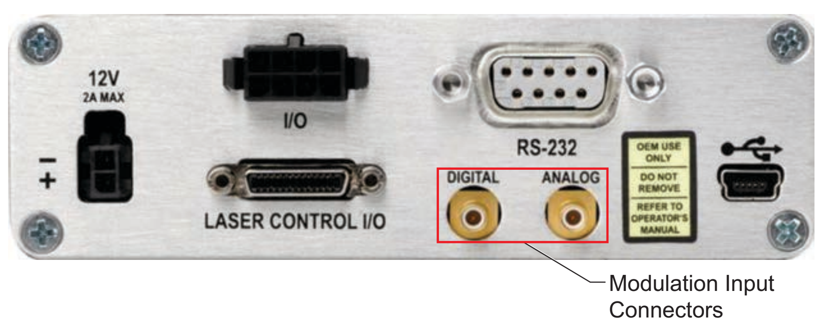


Figure 4-8. Select Modulation Input Connector

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 4-9.

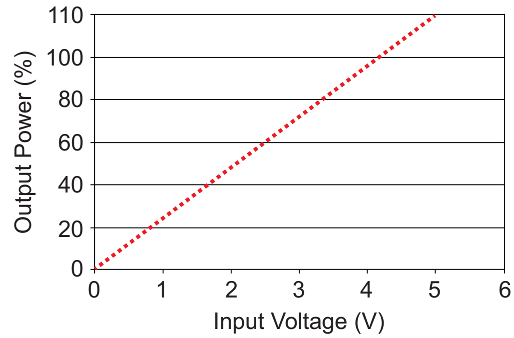


Figure 4-9. Analog Modulation Power vs. Analog Modulation Input Voltage

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 4-10.

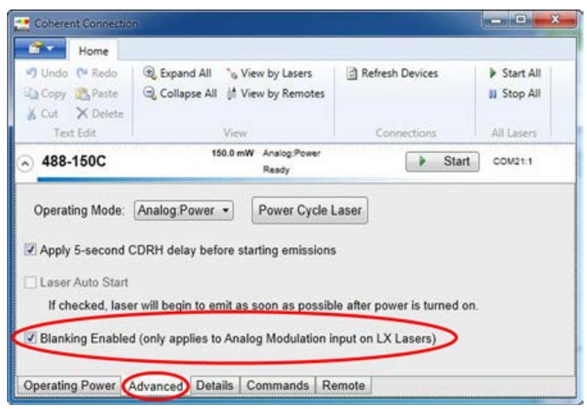


Figure 4-10. OBIS LX – Enable/Disable Blanking

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 4-11

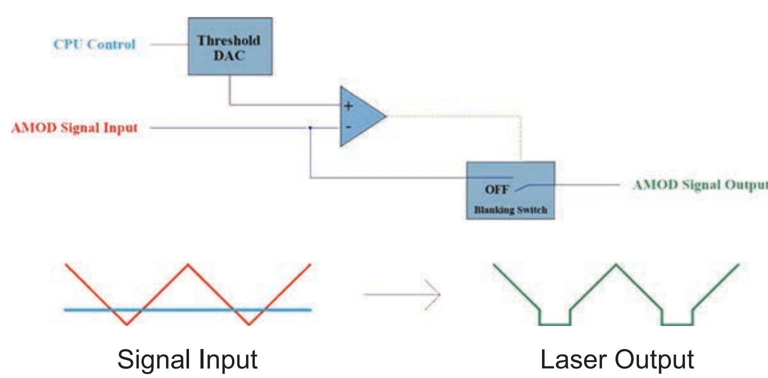


Figure 4-11. OBIS LX – Analog Modulation Blanking Circuit Diagram

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 4-3 lists the electrical characteristics of the analog input.

Table 4-3. 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 4-12 provides an example of a Sine Wave Input/Output.

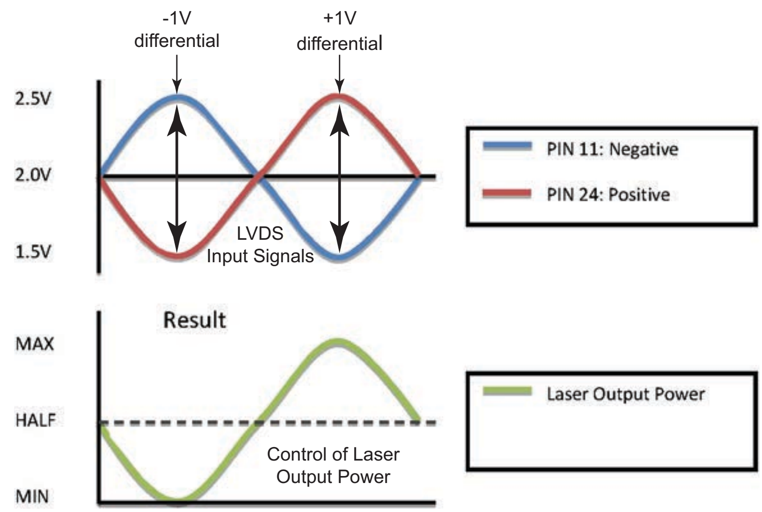


Figure 4-12. Example of Sine Wave Input/Output

Figure 4-13 displays an example of Minimum Power.

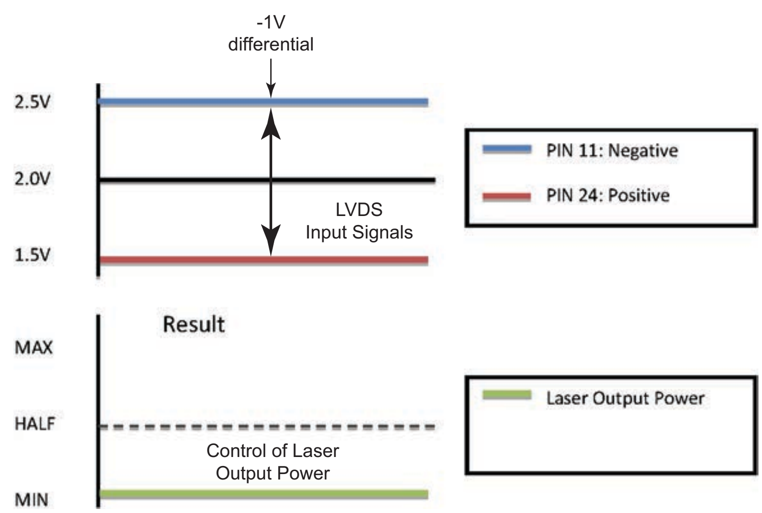


Figure 4-13. Example of Minimum Power

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

OBIS Modulation Input Voltage Levels

Table 4-4 shows the Analog Modulation Input Voltage levels and the related laser output power.

Table 4-4. 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 Applicable
Analog Modulation Minimum Power	Minimum Power	0.0V	-0.930V	0 mW with Blanking Enabled	< 1 mW

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 4-14 displays the pulses for the maximum power and the minimum power output.

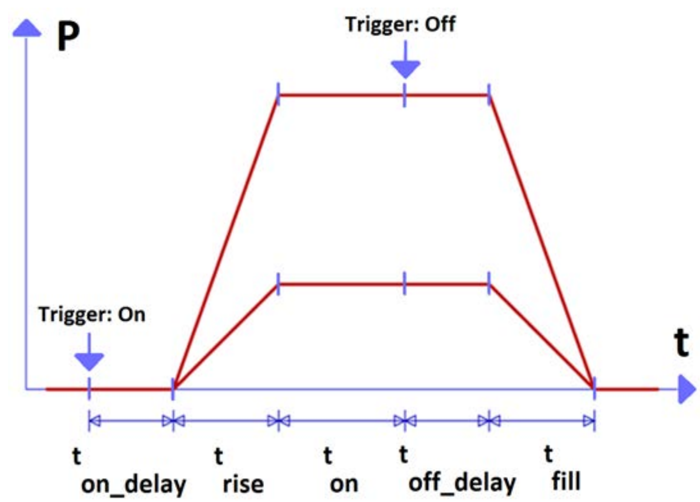
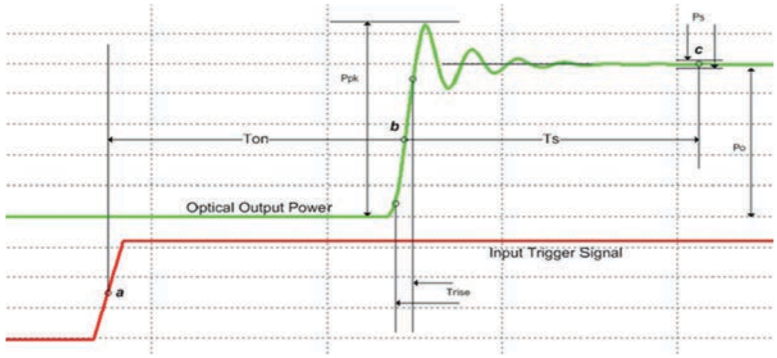


Figure 4-14. Maximum Power and Minimum Power Output Pulse

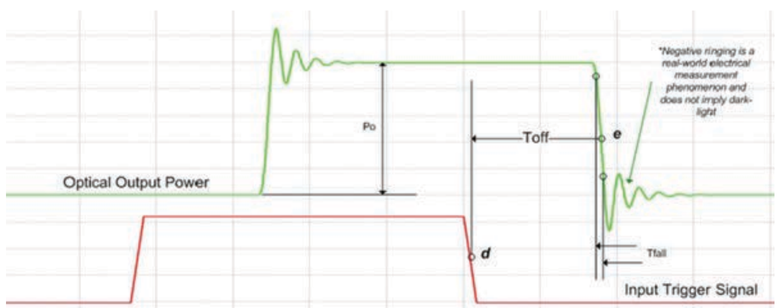
Figure 4-15 displays the Rise Time for the Modulation Pulse.



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 4-15. Modulation Pulse, Rise Time

Figure 4-16 displays the Fall Time for the Modulation Pulse.



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 4-16. Modulation Pulse, Fall Time

Figure 4-17 shows typical waveforms under analog modulation. In this example, the analog signal is a 0 to 5V, 50 kHz, square wave.

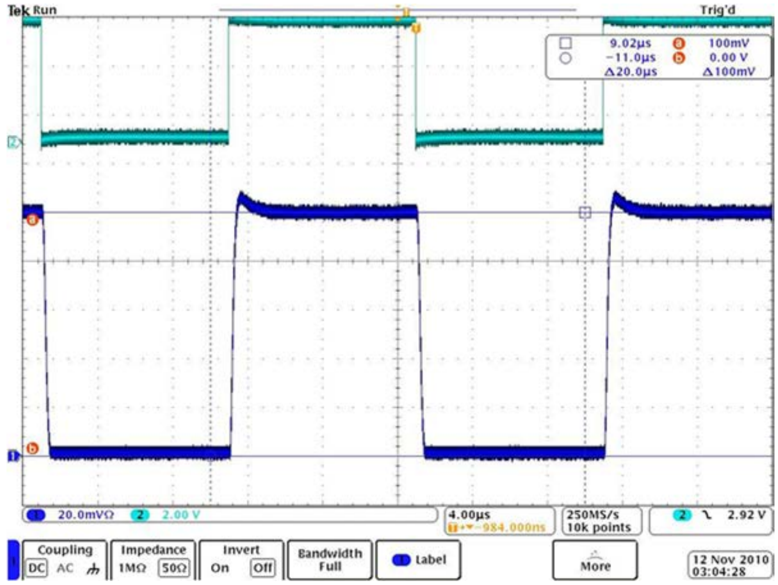


Figure 4-17. Typical Waveforms under Analog Modulation

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 4-5 lists the various digital modulation input voltage levels.

Table 4-5. 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

Notes:

- When operating in Digital Modulation mode at the OBIS Remote SMB input, the voltage input signal needs a minimum 30 mA drive current 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 through a Terminal Program” (p. 6-5).

Choose *Digital Modulation* from the *Operating Mode* drop-down menu on the Advanced tab of the Coherent Connection software program. Figure 4-18 shows the menus for both OBIS LX and OBIS L.

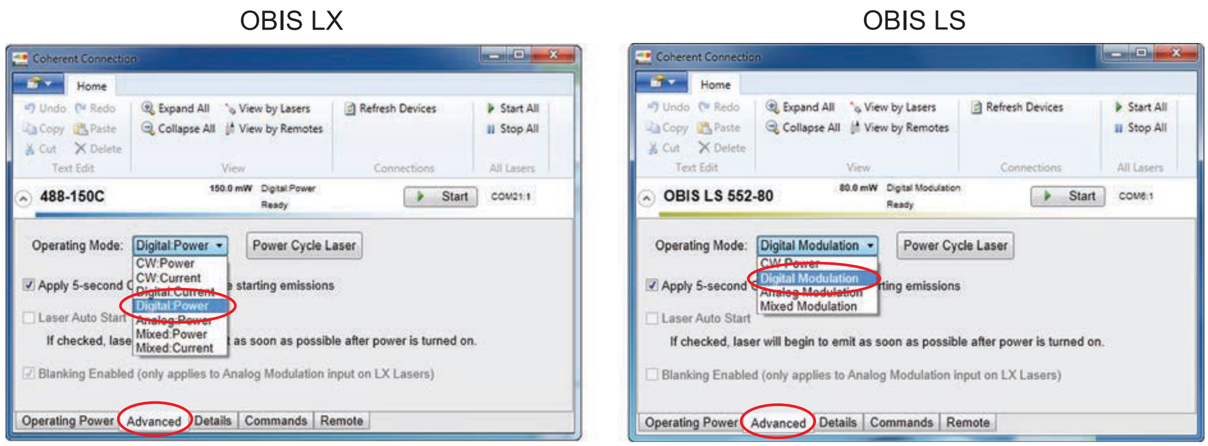


Figure 4-18. Select Digital Modulation

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 4-19, the digital signal is a 1.1 to 3.3 Volts, 10 MHz, square wave.

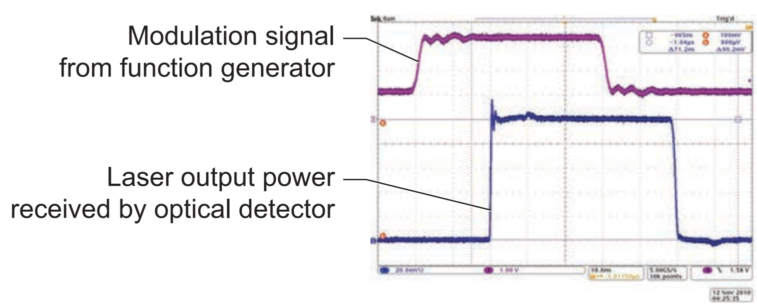


Figure 4-19. Oscilloscope Traces – Digital Modulation

Figure 4-20 shows the typical rise and fall behavior of OBIS Digital modulation. The oscilloscope trace is set to 2 nsec/div.

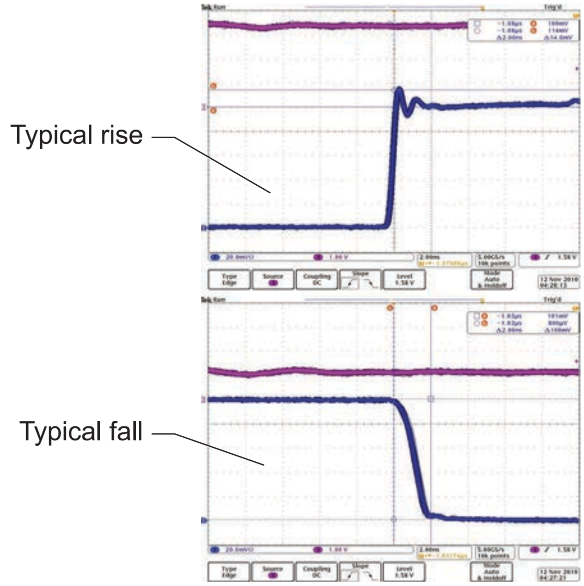


Figure 4-20. Typical Rise and Fall Behavior – Digital Modulation

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 4-21 shows a typical LVDS circuit.

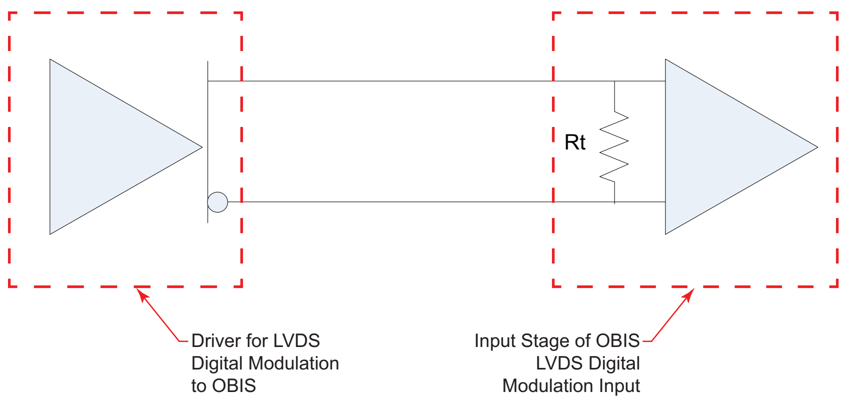


Figure 4-21. LVDS Sample Circuit

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, refer to "Appendix E: OBIS SDR Breakout Board" (p. E-1).

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 4-22 for an example.

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

https://cohrstage.coherent.com/assets/pdf/COHR_OBISfamily_DS_0517_1.pdf

For more information, see "Calibration Command for OBIS LX" (p. 4-18).

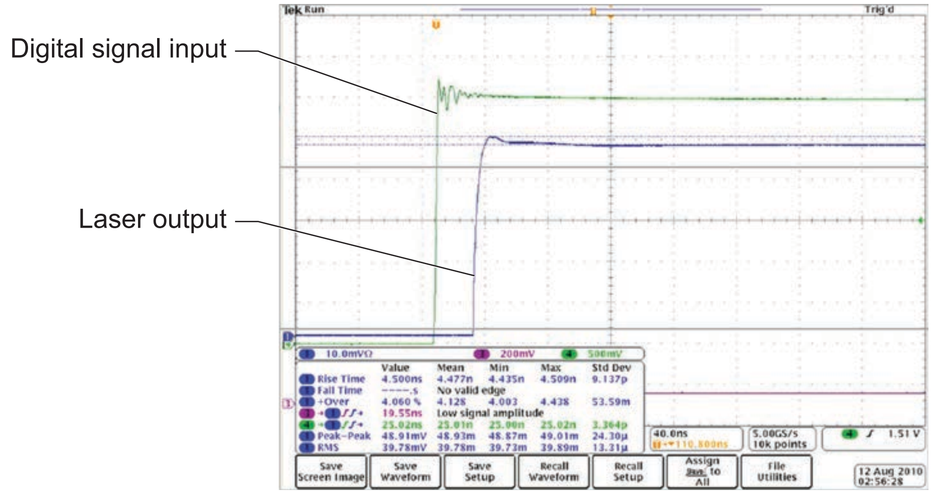


Figure 4-22. OBIS LX Digital Power Input and Laser Output Power

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 4-23. There are separate Modulation Input connectors for:

- Analog modulation
- Digital modulation.

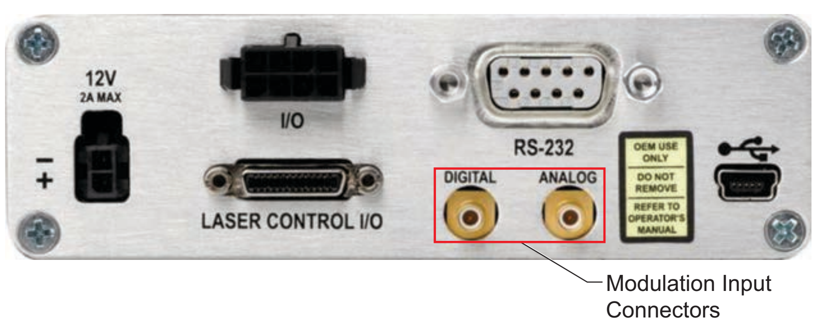


Figure 4-23. Select Modulation Input Connector

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 through a Terminal Program” (p. 6-5).

3. For high-speed modulation, the OBIS LX offers Mixed:Current mode to drive the laser in an open-loop control (see Figure 4-24).

OBIS LX

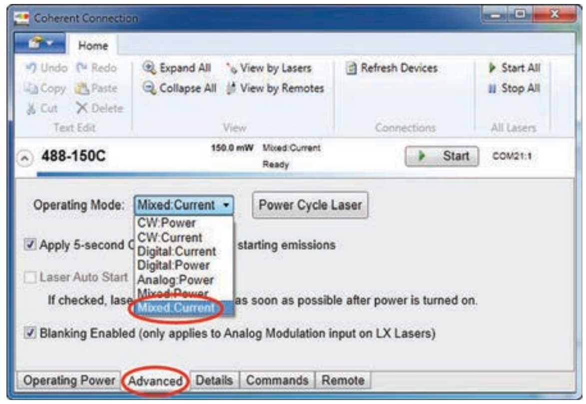


Figure 4-24. Select Mixed Modulation Mode

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 4-25.

OBIS LX

OBIS LS

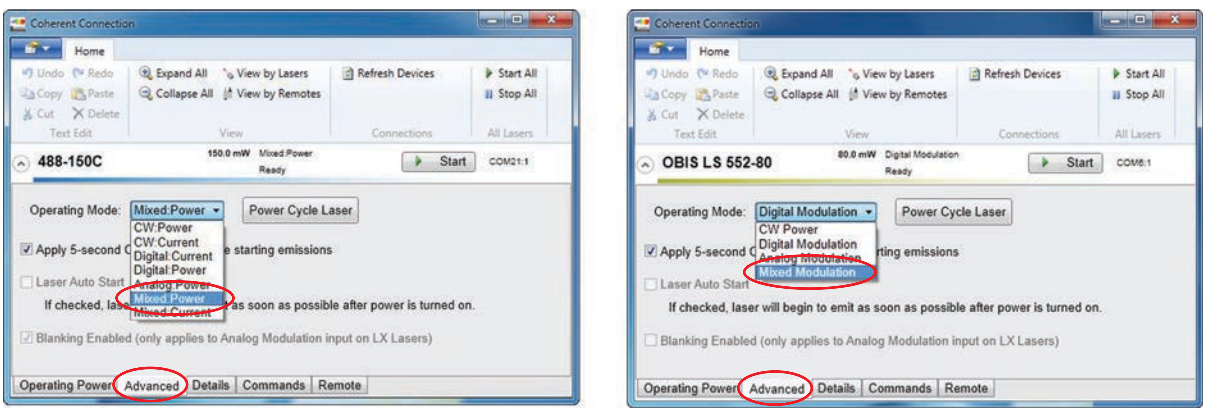


Figure 4-25. Mixed Modulation for OBIS LX and OBIS LS Lasers

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.

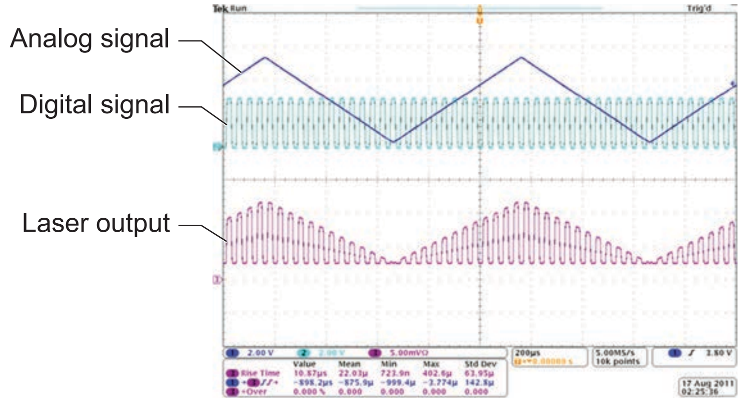


Figure 4-26. Oscilloscope Traces of OBIS Laser Mixed Modulation

Calibration 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 p. B-1).

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 4-27:

  CW:Current

  Digital:Current

  Mixed:Current

- Field recalibration is **not needed** for CW:Power or the other modulation modes that use closed-light-loop.

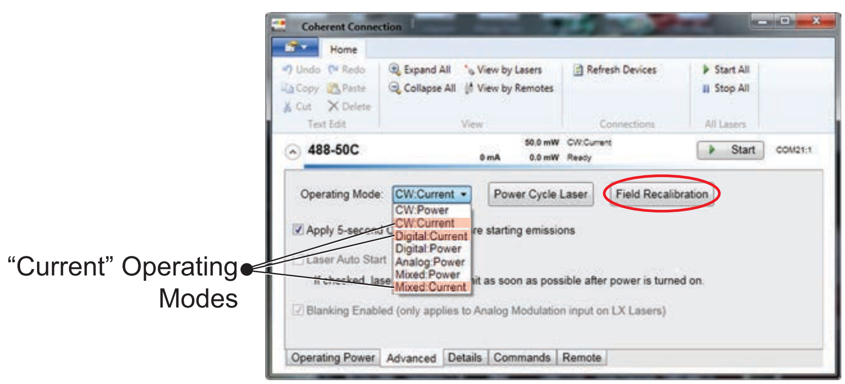


Figure 4-27. Modulation Mode using CURRENT

1. On the Advanced tab, click the **Field Calibration** button shown in Figure 4-28 to start the recalibration process.
2. When you click the **Field Power Recalibration** button, the dialog box shown in Figure 4-29 is displayed.

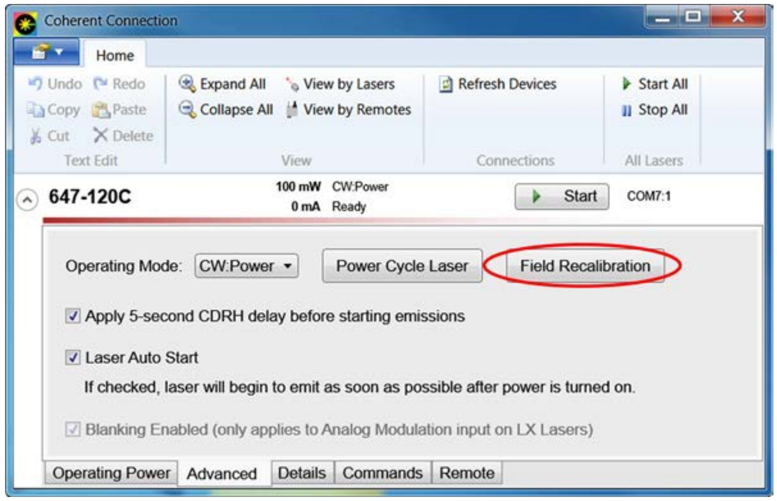


Figure 4-28. Advanced Tab – Field Calibration Command

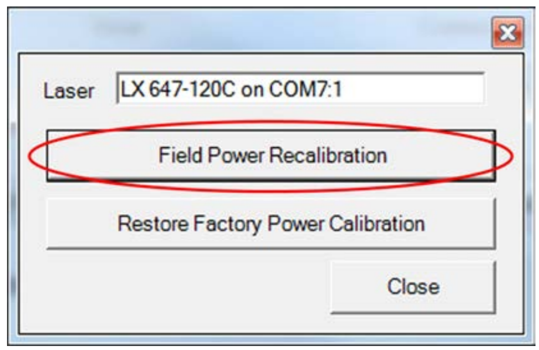


Figure 4-29. Field Calibration Button

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 4-30 to start recalibration.

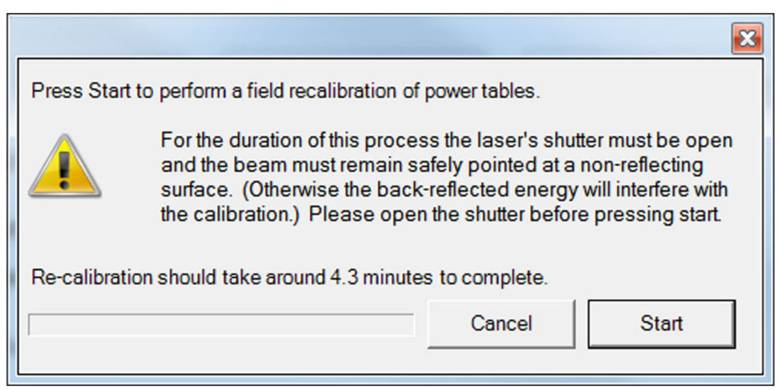


Figure 4-30. Field Calibration—Start Button

During the recalibration process, the OBIS Laser Status indicator flashes, as shown in Figure 4-31.

- 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.

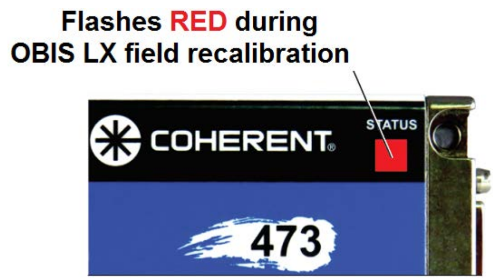


Figure 4-31. OBIS Status LED during Field Calibration

SECTION FIVE: COHERENT CONNECTION

This section describes how to set up and install the Coherent Connection software and related drivers for the OBIS Laser system.

Coherent Connection software supports the following laser products: OBIS LX, OBIS LS, OBIS CORE LS, OBIS LG, OBIS CellX, StingRay, and BioRay.

To download the Coherent Connection software, go to:

http://cohrdownloads.blob.core.windows.net/file/Coherent_Connection_4.zip

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

- Coherent Connection software (p. 5-3)
  - System requirements (p. 5-3)
  - Main tabs (p. 5-3)
- Remote control via USB and RS-232 (p. 5-1)
  - Connect USB/RS-232 for remote control (p. 5-2)
  - Connect USB at the laser (p. 5-2)

For information about using a terminal program, see “OBIS Communications through a Terminal Program” (p. 6-5).

Remote Control via USB or RS-232

Through the Coherent Connection software, you can control laser power or other parameters 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.

To install Coherent Connection software, you must first connect the OBIS laser system to a workstation (personal computer or laptop) using 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 in the laser package).

For information about RS-232 pin-outs, see Table C-11 on page C-32). For information about RS-232 communication settings, see Table C-12 on page C-32.

Using 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.

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

Connect USB/RS-232

Connectors for a USB or RS-232 cable are located on the back panel of an OBIS Remote, as shown in Figure 5-1.

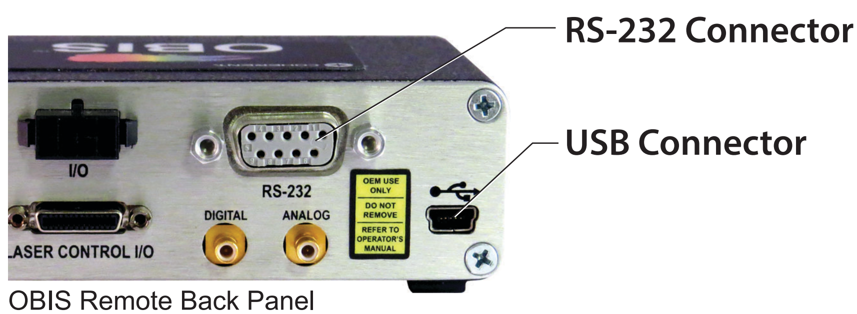


Figure 5-1. Connectors for a USB or RS-232 Cable

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

Connect USB

Figure 5-2 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.

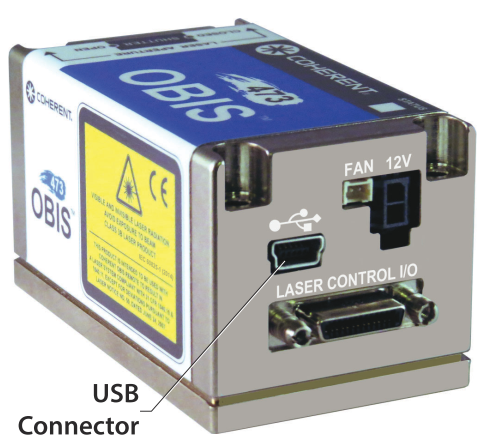


Figure 5-2. USB Connection at the Laser

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

IMPORTANT!
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*.

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 lists the system requirements, introduces the main tabs in the software, and provides instructions to install the software.

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

System Requirements

It is recommended that you use the most current and robust systems possible. Support for the OBIS laser system is provided on the following operating systems:

- Windows® XP (with Service Pack 3)
  NOTE: Functions are supported for backwards compatibility, with no automatic checks for software updates.
- Windows v7 (32- and 64-bit)
- Windows v8 (32- and 64-bit)
- Windows v10 (32- and 64-bit)

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

Overview of the Main Tabs

The following illustrations present each of the tabs in the Coherent Connection Software.

Figure 5-3 shows the Operating Power tab. On this page of the software, you can set power levels.

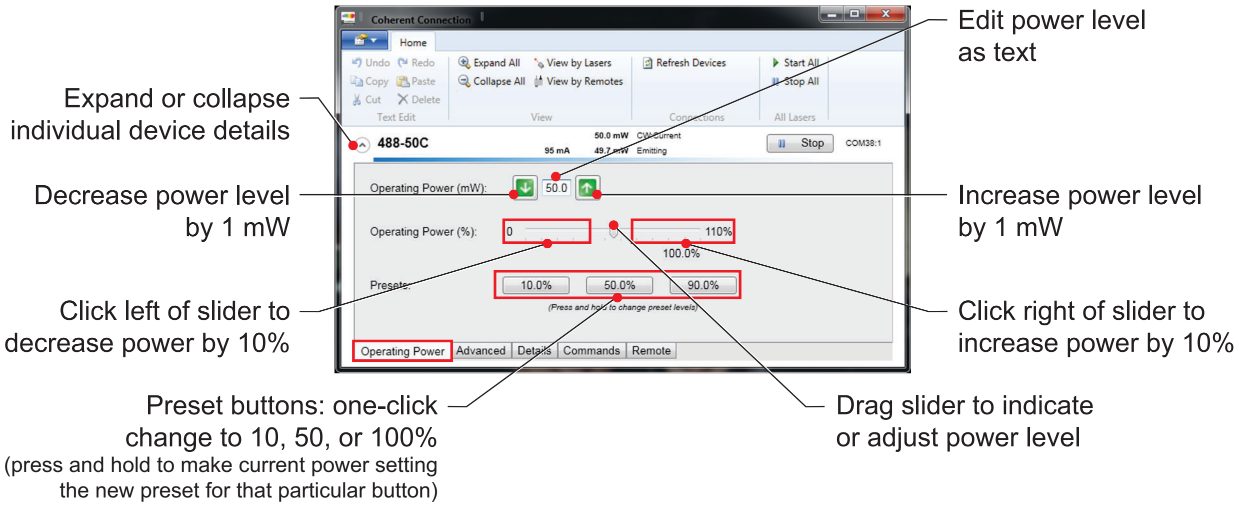


Figure 5-3. Coherent Connection - Operating Power Tab

Figure 5-4 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,

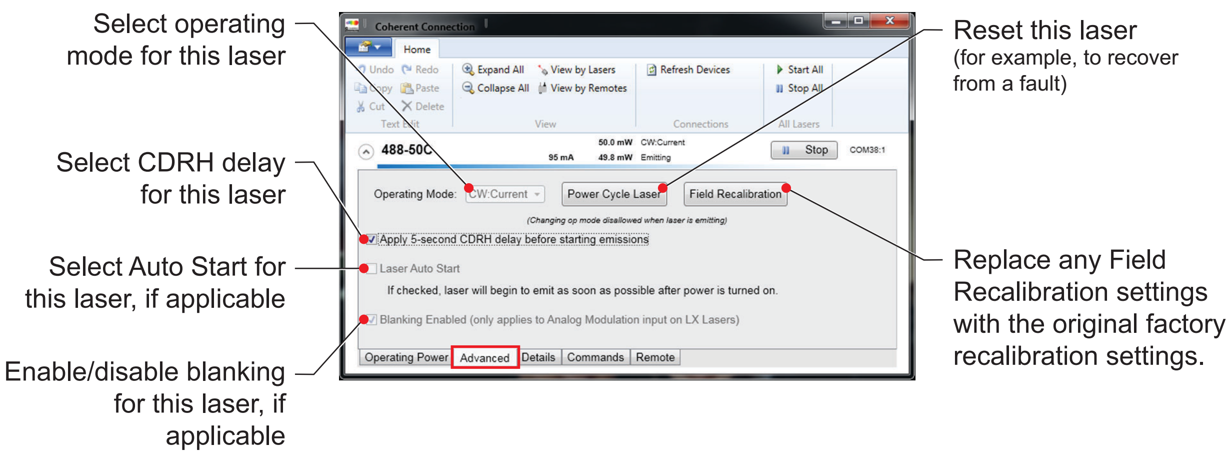


Figure 5-4. Coherent Connection - Advanced Tab

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

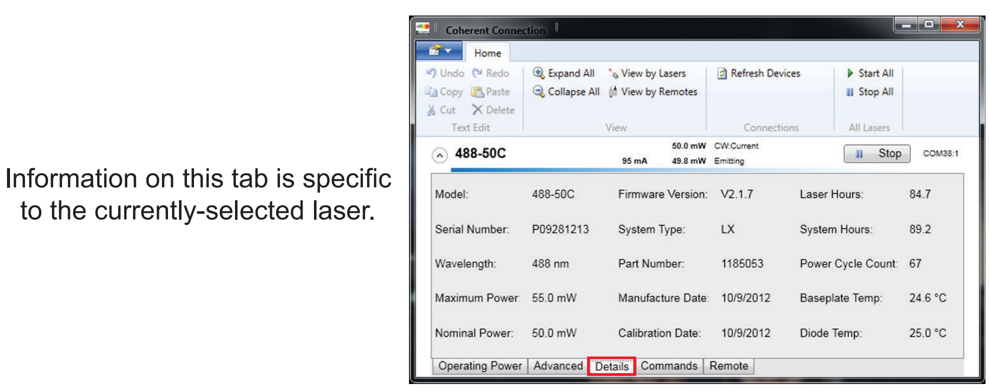


Figure 5-5. Coherent Connection - Details Tab

Figure 5-6 shows the Commands tab. You can view commands and responses, or enter commands to control the laser.

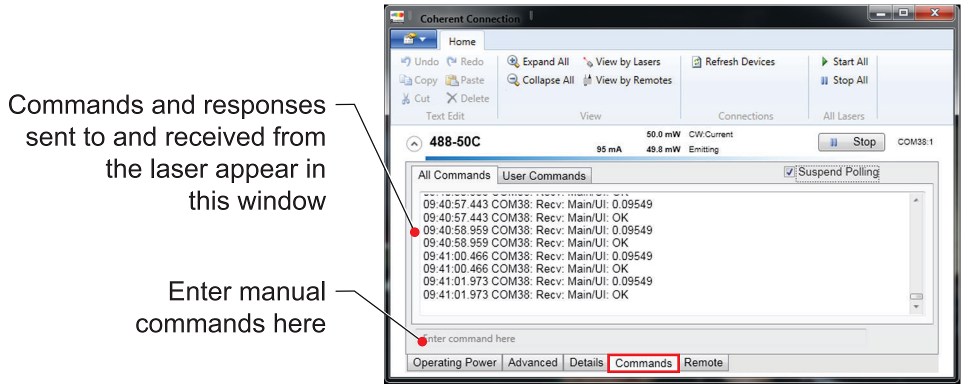


Figure 5-6. Coherent Connection - Commands Tab

Figure 5-7 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.

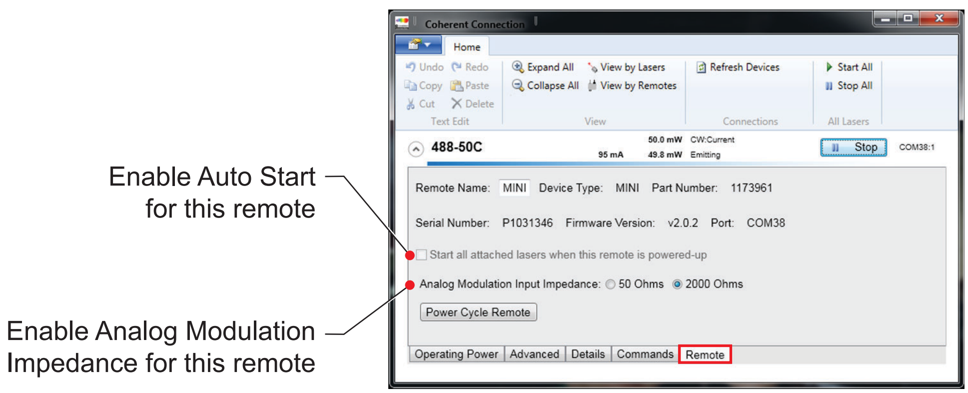


Figure 5-7. Coherent Connection - Remote Tab

Install Coherent Connection Software

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. Close all programs.
2. Insert the OBIS USB memory drive from Coherent into an available USB port on the workstation.
3. Double-click the following file to start the installation process. The last two digits represent the number for the current software build.:

   `Coherent_Connection_Setup_v4.0.0.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 5-8, select the language in which to display the software and click OK.

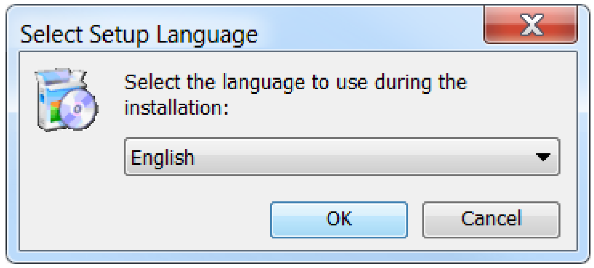


Figure 5-8. Select Language for Software

5. If you had previously installed the Coherent Connection software, the message shown in Figure 5-9 is displayed. Click Yes to proceed.

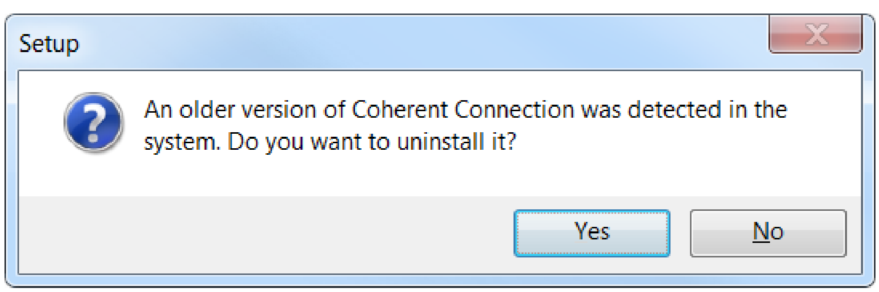


Figure 5-9. Uninstall Old Version of Software

6. The Welcome screen shown in Figure 5-10 is displayed.

Figure 5-10. Welcome Screen for Installation

7. Read the instructions, then click Next. The License Agreement shown in Figure 5-11 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.

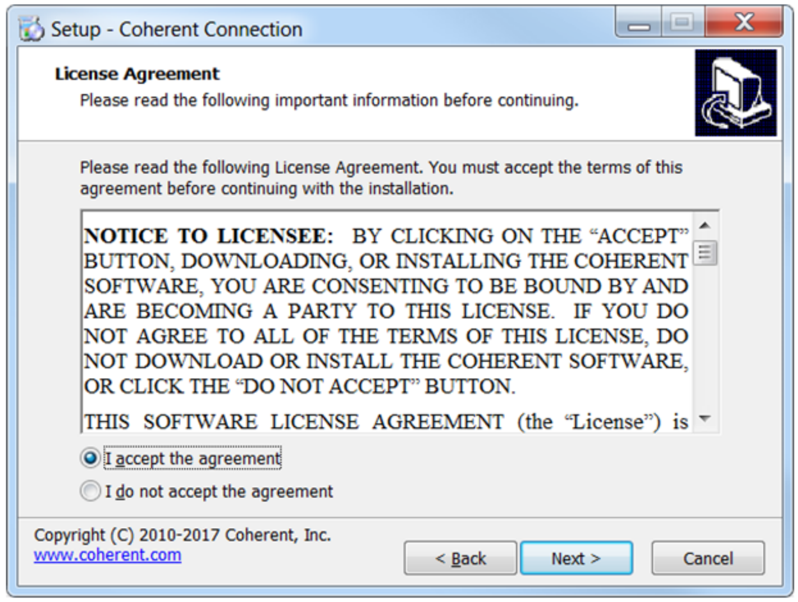


Figure 5-11. Coherent Connection 4 License Agreement

9. The window shown in Figure 5-12 is displayed. Accept the selection, or browse to select the directory on the workstation where you want to install the software, and click Next.

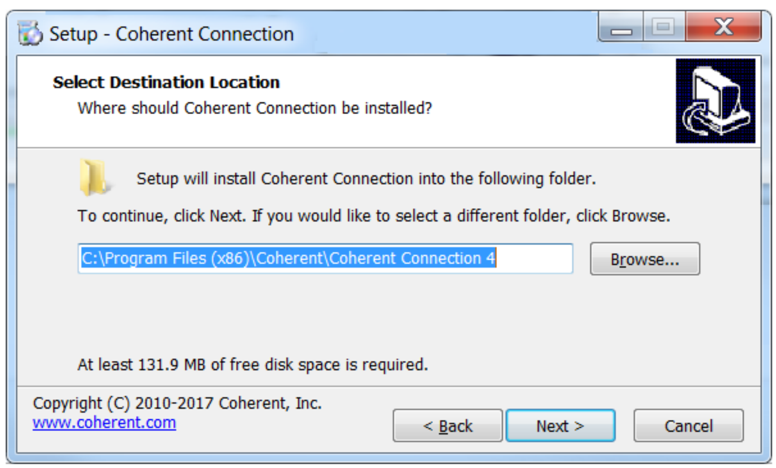


Figure 5-12. Select Directory to Install Software

10. You can create an icon for the software either on your desktop or for a Quick Launch (or both). As shown in Figure 5-13, click the appropriate check box, and then click Next.

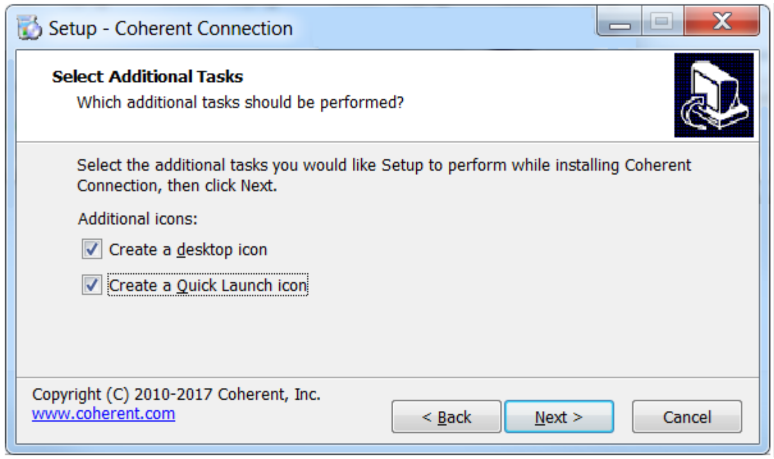


Figure 5-13. Set Desktop or Quick Launch Icon

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 5-14, and then click Next.

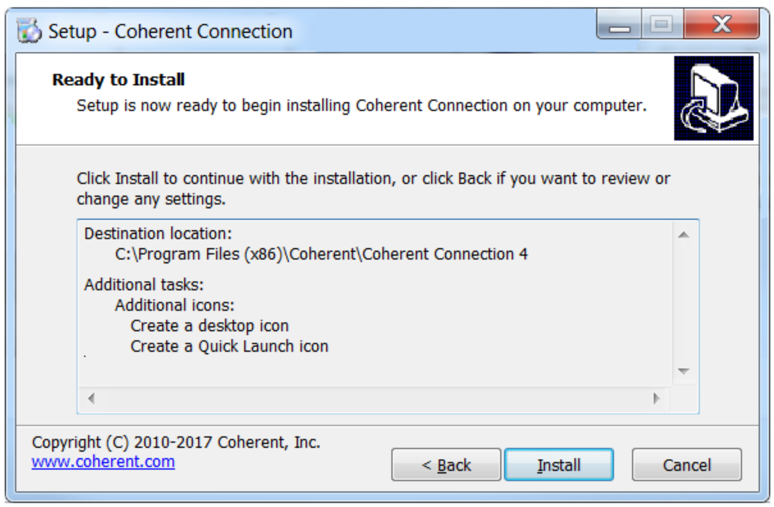


Figure 5-14. Review Set-Up before Installation Begins

A progress bar is displayed, as shown in Figure 5-15.

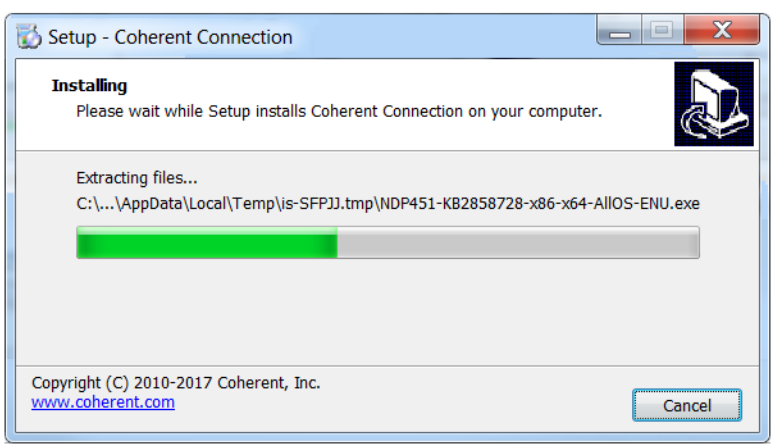


Figure 5-15. Progress of Installation

12. During the installation process, some files are extracted, as shown in the example in Figure 5-16.

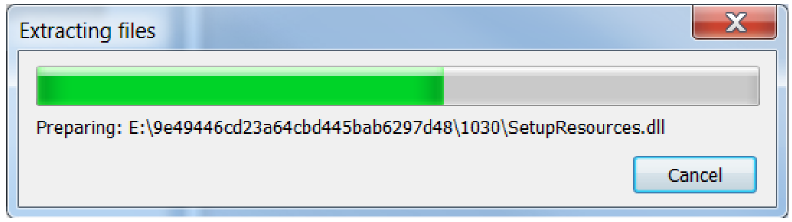


Figure 5-16. Extracting Files

13. After all files are extracted, click Finish. The screen shown in Figure 5-17 closes and the software is ready to be launched.

Figure 5-17. Finish the Software Installation

The software and USB driver are now installed.

If you selected a short-cut (icon) 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 5-18:

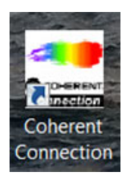


Figure 5-18. Desktop Icon for Coherent Connection Software

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 5-19.

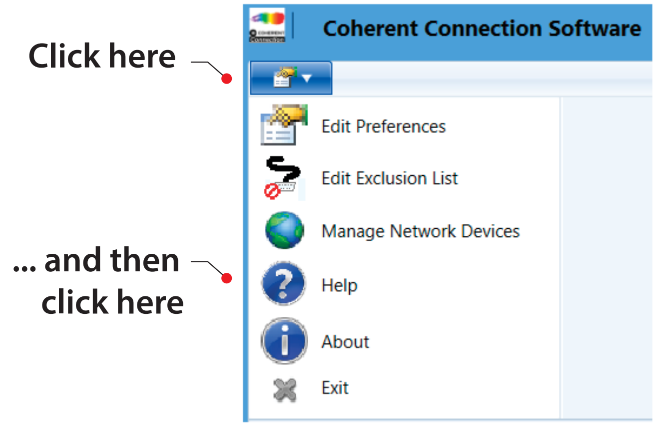


Figure 5-19. Coherent Connection HELP Menu Option

For additional information, go to the Coherent website

https://www.coherent.com/lasers/laser/cw-solid-state-lasers/obis-lasers/obis-lasers

View product information and related materials, including Software files, as shown in the example web page in Figure 5-20:

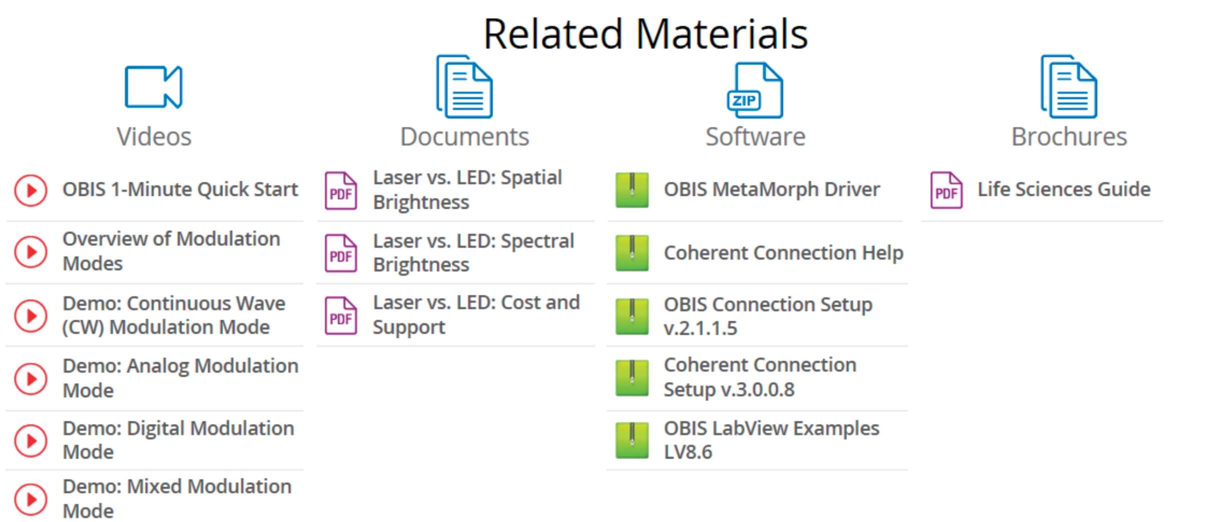


Figure 5-20. Related Product Materials on Coherent Website

SECTION SIX: ADVANCED PROCEDURES FOR THE OBIS LASER SYSTEM

In this section:

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.

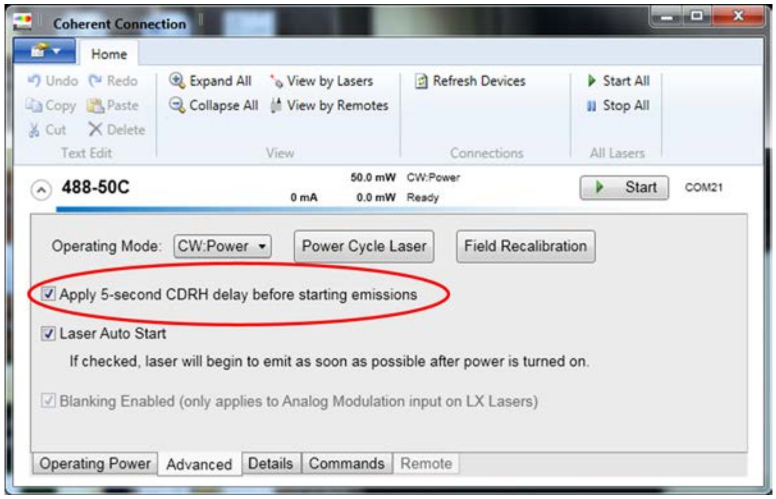


Figure 6-1. Enable/Disable CDRH Delay in Coherent Connection

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 "Appendix C: Host Interface" (p. C-1) for a list of all commands available to communicate with the laser.

Enable Auto Start Using 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 6-2). By default, this switch is set in the OFF position.

Remove the yellow label to access the Auto Start switch.

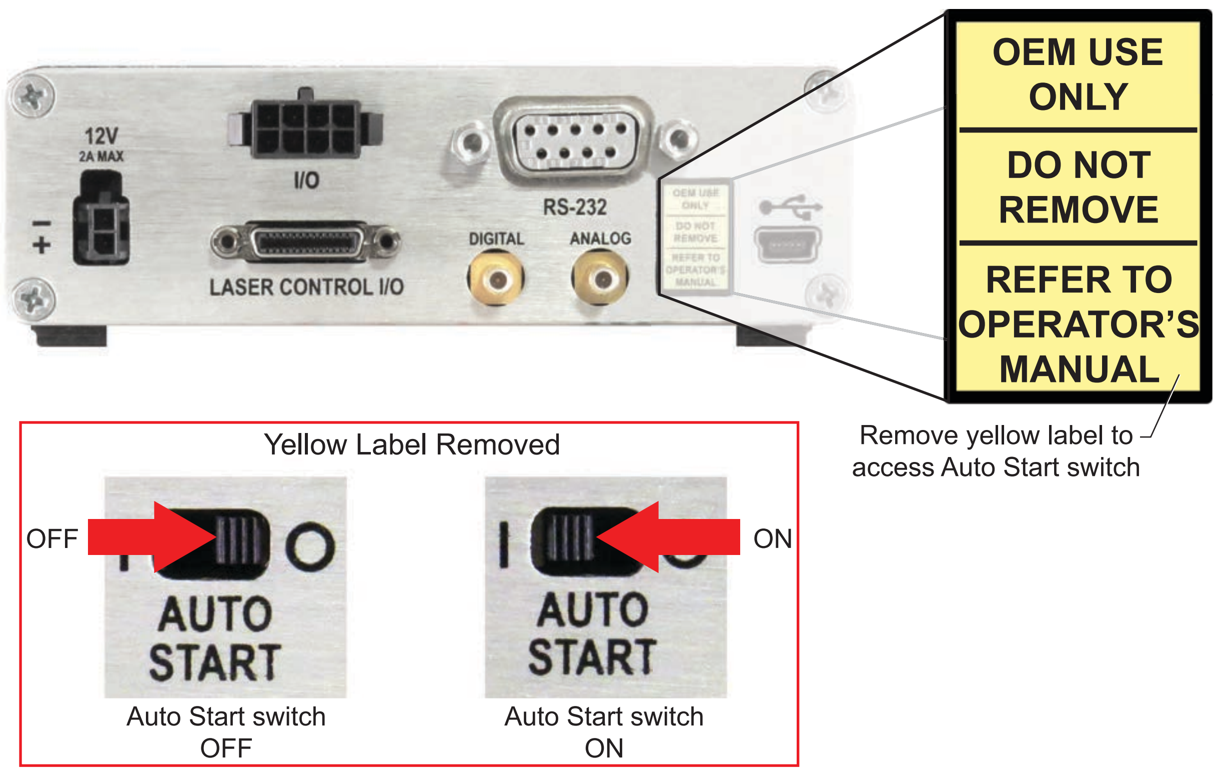


Figure 6-2. OBIS Remote Auto Start Switch Location

Table 6-1 lists system start-up details.

Table 6-1. 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.

Heatsink Requirement

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

Figure 6-3 shows the heat dissipation of the OBIS Laser for several baseplate temperatures.

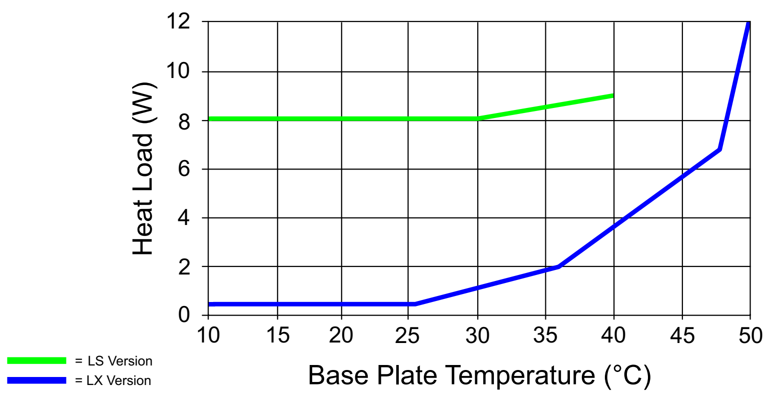


Figure 6-3. Measured Thermal Dissipation Data of the OBIS Laser

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).

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

The graph shown in Figure 6-4 helps determine the heatsink thermal impedance requirement.

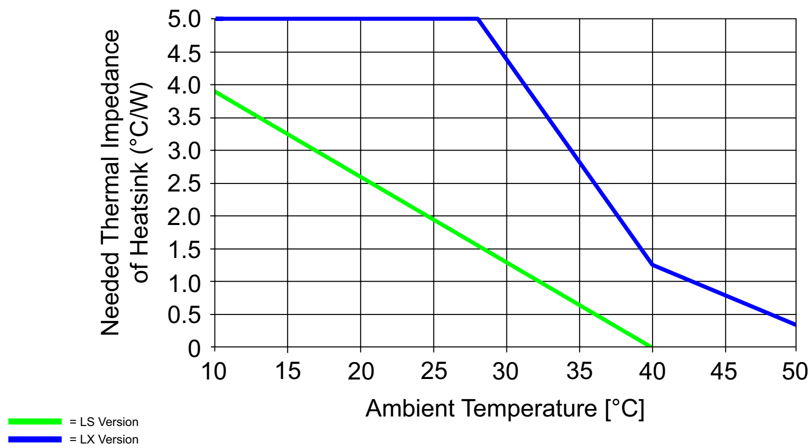


Figure 6-4. Maximum Thermal Impedance of Heatsink to Cool OBIS Laser

OBIS Communications through a Terminal Program

If you want to use a terminal program to open a communication session and enter commands manually, you first need to configure the COM port for the OBIS Laser laser system.

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 the *OBIS Device* under the *Ports (COM & LPT)* heading, as shown in the example in Figure 6-5.

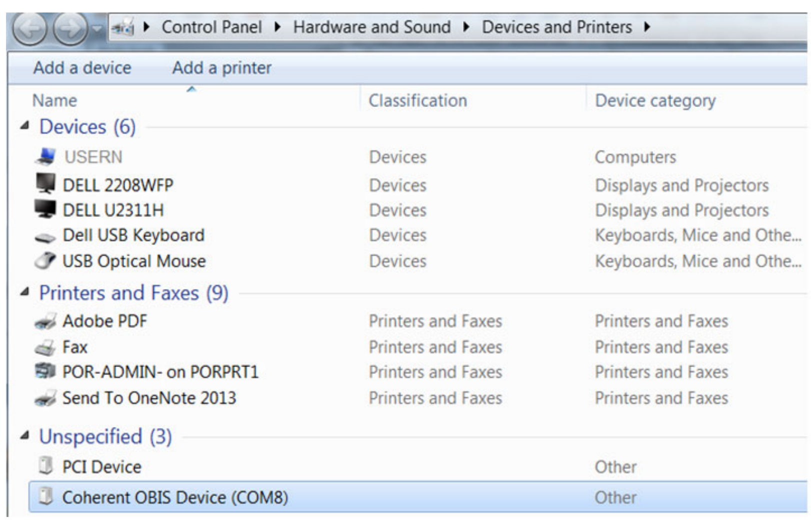


Figure 6-5. Identify the COM Port

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 6-6.

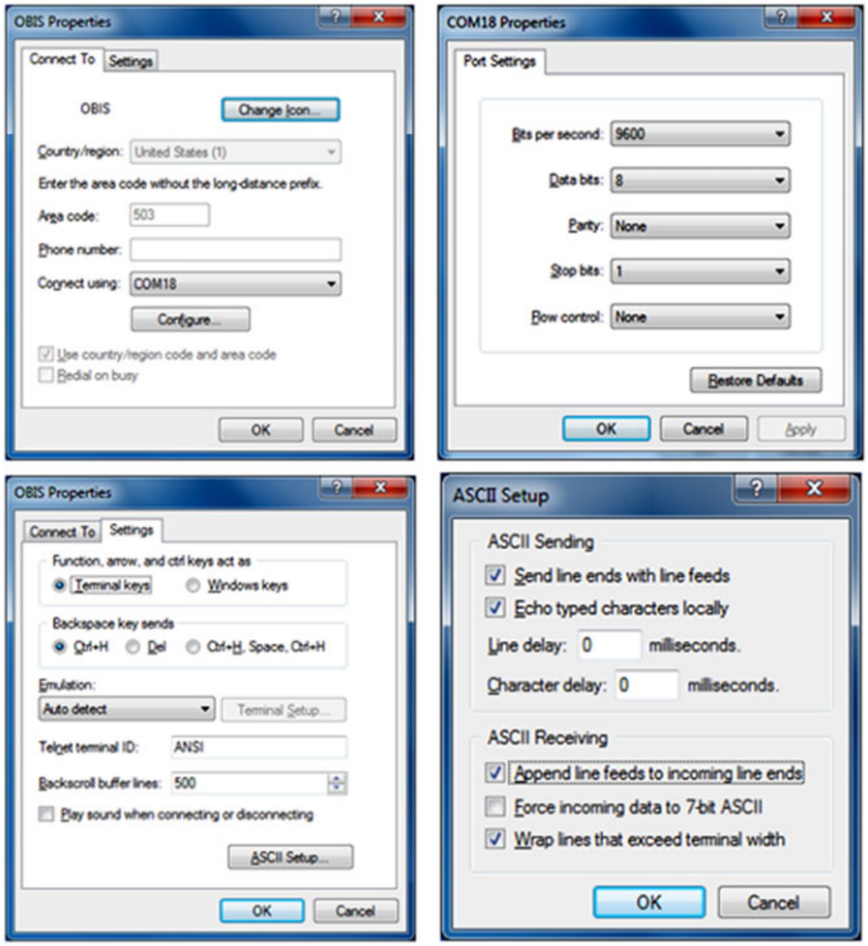


Figure 6-6. Recommended Terminal Menu Settings

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

   The example in Figure 6-7 shows query commands used to check the nominal power level and wavelength of the laser.

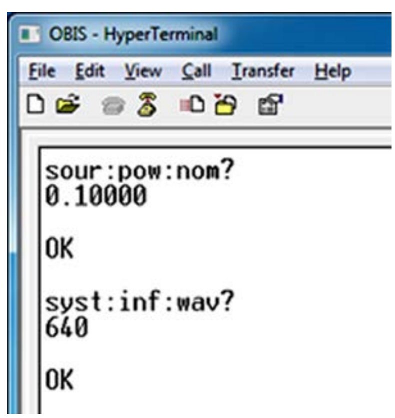


Figure 6-7. Example Query Commands

See "Appendix C: Host Interface" (p. C-1) for a list of all commands available to communicate with the laser.

SECTION SEVEN: USING AN OBIS LASER WITH NO REMOTE

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:

- Installing the OBIS Laser (this page)
- Mounting hardware recommendation (p. 7-2)
- Power supply requirements (p. 7-2)
- Enabling or disabling Auto Start (p. 7-2)
- OBIS Laser SDR connector pin-out specifications (p. 7-2)

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.

Installing the OBIS Laser

Installing the OBIS Laser consists of the following steps:

1. Removing the yellow label that covers the POWER connection. *DO NOT remove the gray label next to it (unless you are using the fan output power).*
2. Connecting the power cable and the optional USB cable (if desired).

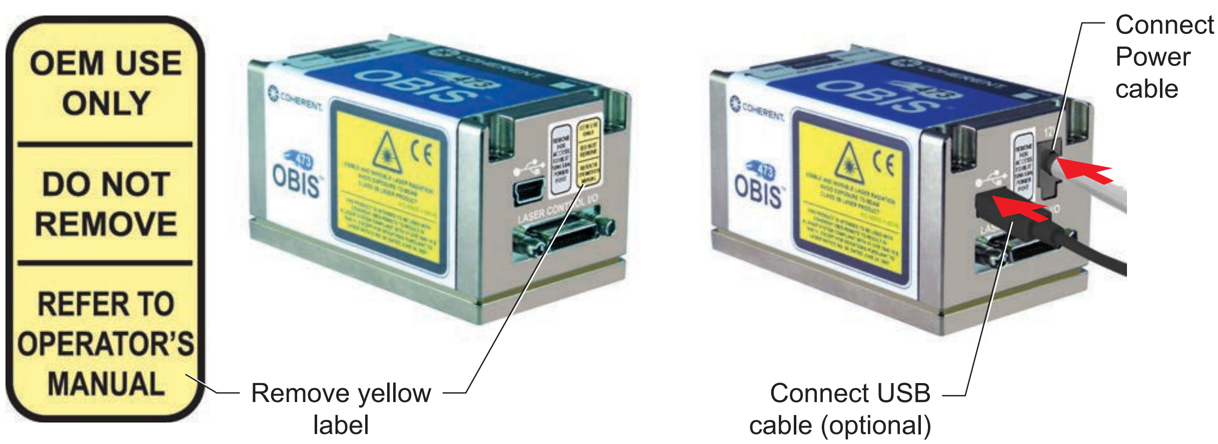


Figure 7-1. Connecting Power and the Optional USB Cable

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 on page 3-6 for the torque pattern.

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 at:

https://cohrstage.coherent.com/assets/pdf/COHR_OBISfamily_DS_0517_1.pdf

Enable or Disable Auto Start

To enable or disable Auto Start, go to the Advanced tab of the Coherent Connection software.

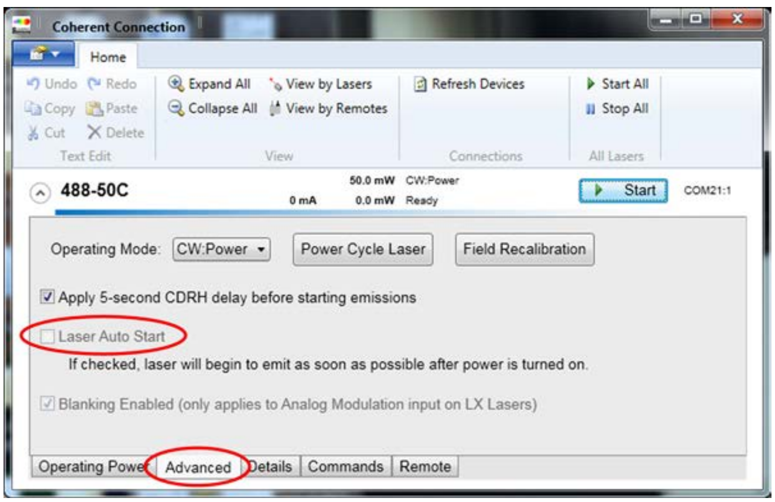


Figure 7-2. OBIS LX (Direct Diode) Auto Start

OBIS Laser SDR Connector Pin-Out Specifications

Table 7-1 lists all required signal connections needed to run the OBIS Laser in CW mode.

Table 7-1. Required Connections for CW Operation

SIGNAL NAME	PIN NUMBER	WIRE COLOR CODE	FUNCTION	CHARACTERISTICS
Power Return	2	Brown	Return for all power and digital lines	Common ground
Power Return	3	Red	Return for all power and digital lines	Common ground
Laser Diode Power	4	Orange	+ 12 VDC for diode supply (no voltage ≥ no diode current)	10 to 14V, up to 1.0A (16W maximum total including fan)
Laser Diode Power	5	Yellow	+ 12 VDC for diode supply (no voltage ≥ no diode power)	Parallel pin for extra current capacity
System Power	6	Green	+ 12V for general supply	10 to 14V, up to 1.0A (16W maximum total including fan)
SDR In-Use Return	13	White	Enables RS-485 control. Switching signal for SDR usage, USB inhibit. NOTE: Not required to enable LVDS modulation inputs.	Connected to GND on laser, signal must be looped back to pin 14 of SDR connector on host to enable RS-485 control via the SDR interface.
SDR in-Use	14	Pink	Enables RS-485 control. Switching signal for SDR usage, USB inhibit. NOTE: Not required to enable LVDS modulation inputs.	Pulled-up with 10K to 3.3V on laser, signal must be looped back to pin 13 of SDR connector on host to enable RS-485 control via the SDR interface.
Power Return	15	Light Green	Return for all power and digital lines	Common ground
Power Return	16	Black/ White	Return for all power and digital lines	Common ground
Laser Diode Power	17	Brown/ White	+ 12 VDC for diode supply (no voltage ≥ no diode current)	Parallel pin for extra current capacity
System Power	18	Red/ White	+ 12V for general supply	Parallel pin for extra current capacity
System Power	19	Orange/ White	+ 12V for general supply	Parallel pin for extra current capacity

Table 7-2 provides a detailed list of all signals for the OBIS Laser SDR connector.

Table 7-2. OBIS Laser SDR Connector Pin-Out Specifications

SIGNAL NAME	PIN NUMBER	WIRE COLOR CODE	DIRECTION	FUNCTION	CHARACTERISTICS
RS-485 Inhibit	1	Black	Digital Input	RS485 communication 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 communication. ***Default: Low (ground) for OBIS LX with firmware prior to 2.2.x***. Refer to "Appendix F: OBIS RS-485 Interface" (p. F-1).
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)
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 impedance ≤ 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 communication line	See RS-485 specifications for detailed description. Half-duplex 1 MBit 8N1 @ 0 to 3.3V
Analog Modulation 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

Table 7-2. OBIS Laser SDR Connector Pin-Out Specifications (continued)

SIGNAL NAME	PIN NUMBER	WIRE COLOR CODE	DIRECTION	FUNCTION	CHARACTERISTICS
Digital Modulation 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
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 communication line	See RS-485 specifications for detailed description.
Analog Modulation Positive	24	Blue	Analog Input	Positive analog modulation line	Positive line for analog power modulation (1Vpp differential, 0 to 4V on any line) 100 ohm termination against pin 11

Table 7-2. OBIS Laser SDR Connector Pin-Out Specifications (continued)

SIGNAL NAME	PIN NUMBER	WIRE COLOR CODE	DIRECTION	FUNCTION	CHARACTERISTICS
Digital Modulation Positive	25	Yellow	Digital Input	Positive digital modulation 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	Shell	Drain	GND	Shield drain	Common ground

Table 7-3 lists the twisted pair combinations. The shields for twisted-pairs 1 to 3 are all connected to the shell-to-shell shield braid at both ends.

Table 7-3. Twisted Pair Combinations

SIGNAL NAME	PIN NUMBER	WIRE COLOR CODE	PAIR NUMBER	FUNCTION
RS-485 Communication Positive	10	Red	1	RS-485 Communication line
Analog Modulation Negative	11	Orange	2	Negative analog modulation line
Digital Modulation Negative	12	Brown	3	Negative digital modulation line
RS-485 Communication Negative	23	Green	1	RS-485 Communication line
Analog Modulation Positive	24	Blue	2	Positive analog modulation line
Digital Modulation Positive	25	Yellow	3	Positive digital modulation line

SECTION EIGHT: TROUBLESHOOTING

Introduction

If you have problems with the OBIS Laser System, refer to Table 8-1, below. If you cannot solve the problem or need more assistance, call Coherent Technical Support at 1.800.367.7890 (1.408.764.4557 outside the U.S.), e-mail Product.Support@Coherent.com, or contact your local Coherent service representative (see www.Coherent.com for worldwide contacts).

Other troubleshooting information available in this manual:

- OBIS 6-Laser Remote (p. 10-11)
- OBIS Scientific Remote (p. 11-32)
- OBIS Laser Box (p. 12-1)
- OBIS Galaxy Beam Combiner (p. 13-1)

CAUTION!
Take ESD precautions when handling and installing a laser. Refer to "Electrical Safety" (p. 1-6) for a complete description of ESD precautions.

Troubleshooting Procedures

Table 8-1 lists possible problems, with a reference to the related troubleshooting checklist.

Table 8-1. OBIS System Troubleshooting Procedures

PROBLEM	REFERENCE
No output power from the laser	Checklist 1 (p. 8-2)
Laser output power is lower than expected	Checklist 2 (p. 8-2)
Base plate temperature error	Checklist 3 (p. 8-3)
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. 8-4)
The LED on top of the OBIS Laser is not functioning	Checklist 5 (p. 8-4)

Checklist 1: 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. 2-8) and "OBIS Remote Status Indicators" (p. 2-21). 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 "System Fault Query" (p. C-14).

[ ] 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—refer to "Introduction" (p. 8-1) for contact information.

Checklist 2: 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. 2-8) and "OBIS Remote Status Indicators" (p. 2-21). 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 “System Fault Query” (p. C-14).

[ ] 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 “Calibration Command for OBIS LX” (p. 4-18).

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Checklist 3: 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. 6-4). 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). 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.

Checklist 4: 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.

Checklist 5: 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.

SECTION NINE: OBIS LASER REPACKING PROCEDURE

This section describes the factory-recommended repacking procedure for both the OBIS Laser System (p. 9-3) and OBIS FP Laser System (p. 9-4). The applicable procedure must be followed if the laser system will be 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 1.800.367.7890 (1.408.764.4557 outside the U.S.)\
- Send an e-mail to Product.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.

Components Shipped

Table 9-1 lists the components sent with the different OBIS Laser System configurations.

Table 9-1. Components Shipped

ITEM DESCRIPTION	INCLUDED WITH							
	LASER	LASER SYSTEM	OBIS REMOTE	OBIS 6-LASER REMOTE	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	

Table 9-1. Components Shipped (continued)

Item Description	Included with							
	Laser	Laser System	OBIS Remote	OBIS 6-Laser Remote	OBIS Scientific Remote	OBIS Laser Box	OBIS Galaxy	Spare Parts Accessory Bag
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
USB memory drive for Documentation and Coherent Connection software		X	X	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		
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.

OBIS Repacking Procedure

When using the following procedure, refer to Figure 9-1 to correctly position all components in the shipping box.

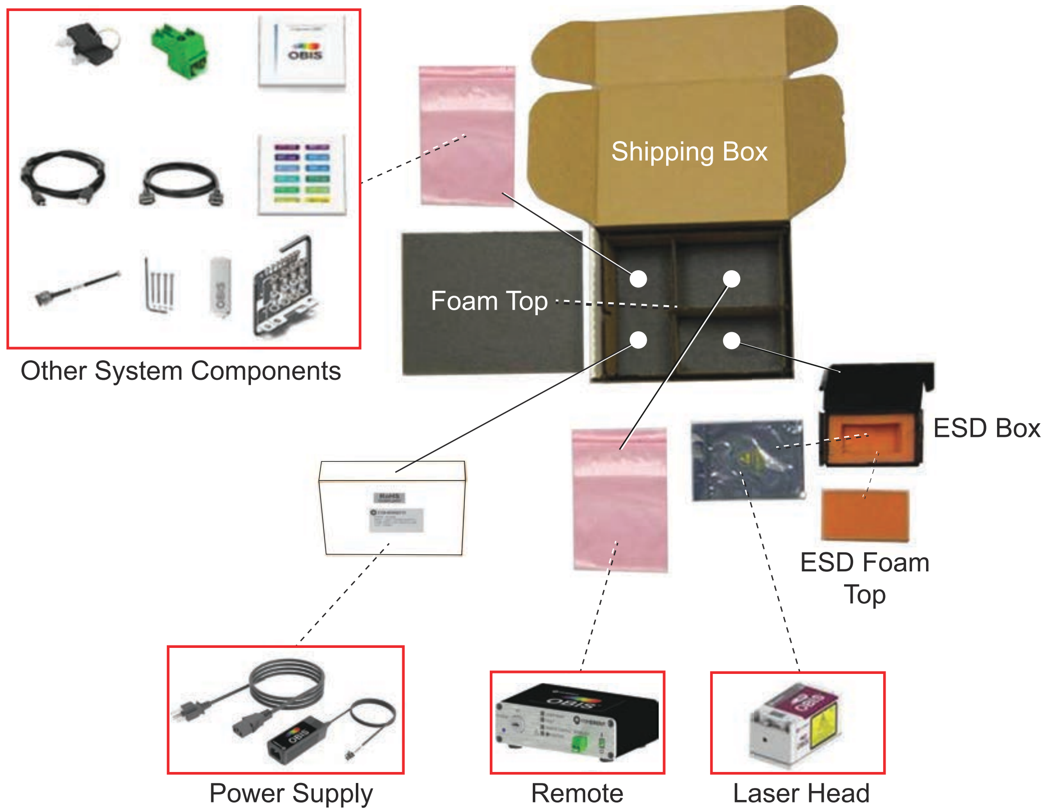


Figure 9-1. OBIS Shipping Container Showing Component Placement

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.
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 (1.800.343.4912) to get a return material authorization (RMA) number.
- Include the RMA number on the shipping label.

OBIS LX FP Repacking Procedure

When using the following procedure, refer to Figure 9-2 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.

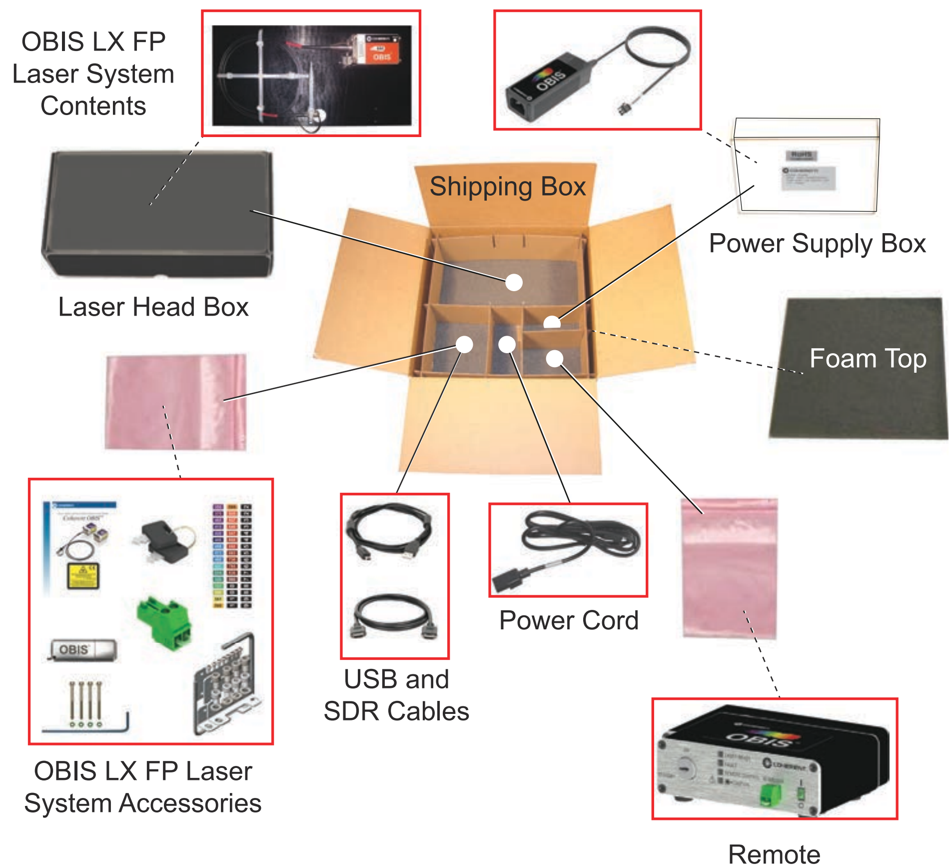


Figure 9-2. OBIS LX FP Shipping Container Showing Component Placement

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 9-3).

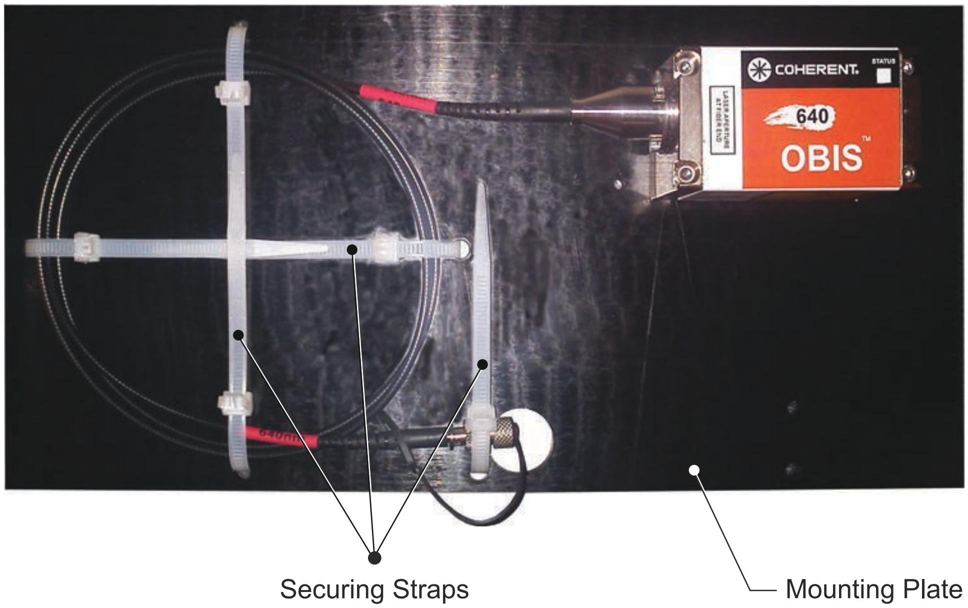


Figure 9-3. OBIS FP Laser Secured to the Mounting Plate

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.
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 (1.800.343.4912) to get a RMA number.
- Include the RMA number on the shipping label.

OBIS LS FP Repacking Procedure

Repacking an OBIS LS FP laser requires special handling.

IMPORTANT!
DO NOT touch the laser fiber output!
Use Nitrile gloves whenever you handle the fiber output.

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 9-4.

Figure 9-4. 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 9-5. 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.

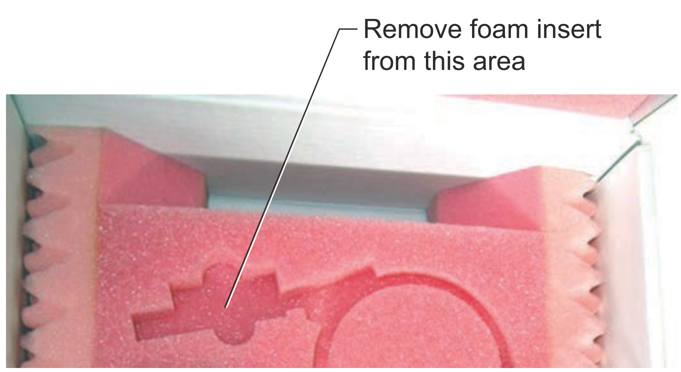


Figure 9-6. Packaging with Foam Insert Removed

CAUTION!
DO NOT bend the fiber!

4. Carefully position the laser and wind the fiber as shown in Figure 9-7. Make sure the fiber end is set in the designated space in the packaging foam.

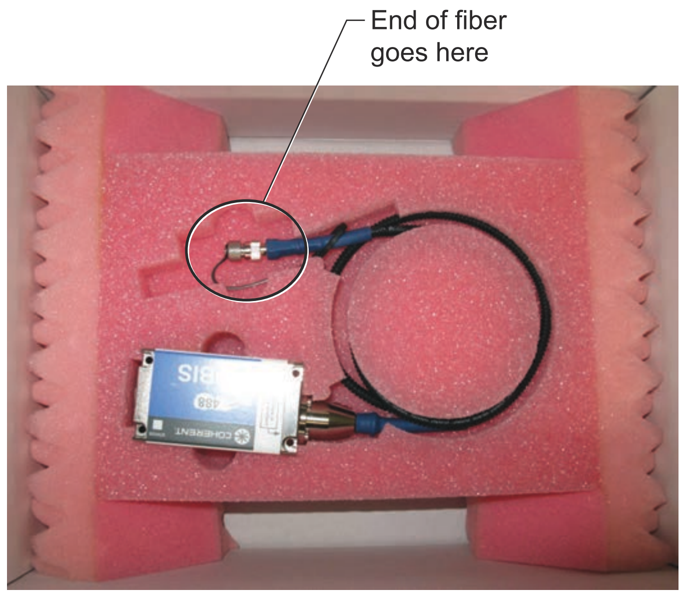


Figure 9-7. Fiber Positioned in Packaging Foam

5. Place the small foam insert (removed in Step 3, above) over the fiber end to secure it for shipping, as shown in Figure 9-8.

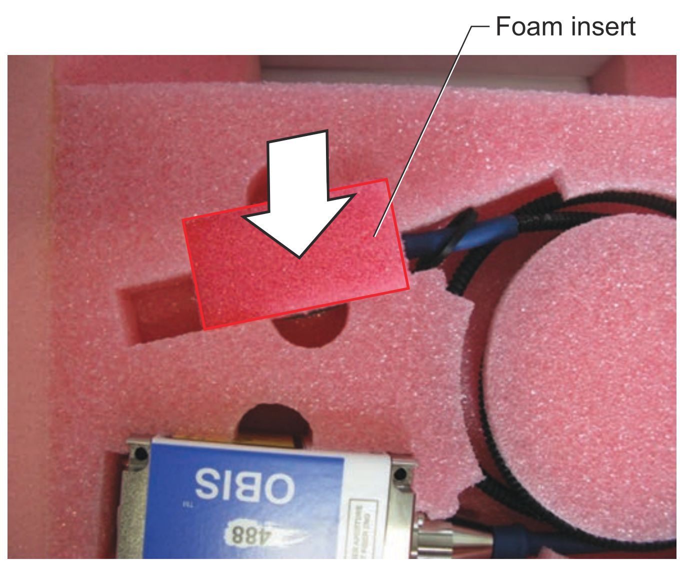


Figure 9-8. Fiber End Secured in Packaging Foam

6. Place the cover packaging foam, cone side facing down, onto the OBIS LS FP in the cover foam as shown in Figure 9-9.
   - 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 9-9. Cover Foam in Place in the Shipping Box

7. Close the shipping box and secure the box with tape, as shown in Figure 9-10.

Figure 9-10. OBIS LS Laser Fiber-coupled Packaging Set

If you are returning the system to Coherent for service:

- Contact Coherent Customer Service (1.800.343.4912) to get a RMA number.
- Include the RMA number on the shipping label.

SECTION TEN: OBIS 6-LASER REMOTE

In this section:

Components and Accessories

Figure 10-1 shows the components and accessories for the OBIS 6-Laser System.

Figure 10-1. OBIS 6-Laser System Components and Accessories

Table 10-1 lists the components and accessories for the OBIS 6-Laser System.

Table 10-1. OBIS 6-Laser System Components and Accessories

ITEM	DESCRIPTION	PART NUMBER
1	OBIS 6-Laser Remote	1203909
2	Power supply, 100 to 240 VAC, 12 VDC, 10.8A, IEC-320	1211389
3	Power cord, USA to IEC-320	1106344
4	Wavelength labels for OBIS Remote (P/N 1190348)	1190348
5	OBIS Laser Safety and Installation Quick Start Guide	1185449
6	OBIS LX/LS Operator's Manual (included as a PDF file on the USB Flash Drive)	1184163
7	Mounting brackets/hardware for OBIS Remote	1211976
8	USB memory drive for software control	Included in Spares Kit – see P/N 1190348
9	Keys for OBIS Remote (2 each)	
10	Cable, 2-pin, power for OBIS 6-Laser Remote (1 meter), (6 each)	
11	Interlock, shorted, for OBIS Remote	

For additional details and other accessories, refer to "Appendix B: OBIS Accessories Parts List" (p. B-1). Also see information about the OBIS 6-Laser Remote on the Coherent website at:

https://www.coherent.com/lasers/laser/obis-accessories/obis-6-laser-remote

Description

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

The OBIS 6-Laser Remote for OBIS LX/LS offers 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-type connector for laser control I/O. All of these connectors are on the back panel of each OBIS LX/LS laser.

To simplify integration, the OBIS 6-Laser Remote connects to the 12 VDC Power Input on the back panel of the OBIS Laser. This feature lets the OBIS 6-Laser Remote provide power On/Off to the laser.

For applications requiring laser status and control, the USB on the back panel of each OBIS Laser can be used to communicate directly with the laser.

The OBIS 6-Laser Remote is not recommended for applications that require analog or digital modulation.

OBIS 6-Laser Remote comes with mounting brackets and hardware to either mount the remote to a table or stack remotes.

Front Panel

Figure 10-2 shows the front panel of the OBIS 6-Laser Remote.

Figure 10-2. OBIS 6-Laser Remote Front Panel

Keyswitch

The OBIS 6-Laser Remote has a keyswitch, shown in Figure 10-3. This keyswitch prevents generation of laser radiation when the keyswitch is in the STANDBY position. Laser radiation can occur when the key is in the ON position. The key is removable in the STANDBY position, but not in the ON position.

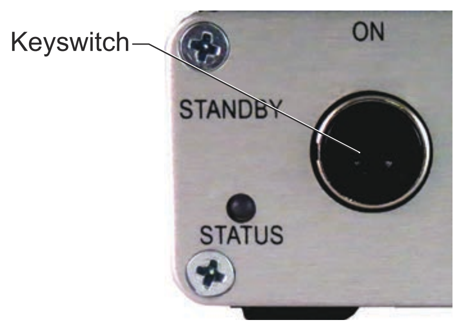


Figure 10-3. OBIS 6-Laser Remote Keyswitch

The keyswitch is the CDRH Manual Reset feature: After an interlock fault or power interruption, the laser will not auto restart unless the keyswitch is first reset to STANDBY, then returned to ON.

Figure 10-4 shows the keyswitch in the STANDBY and ON positions.

Figure 10-4. OBIS 6-Laser Remote Keyswitch STANDBY and ON Positions

Status LED Indicator

The Status LED indicator is located on the front panel, shown in Figure 10-5. The LED indicator displays green, blue or red. The state of the OBIS 6-Laser Remote determines the color.

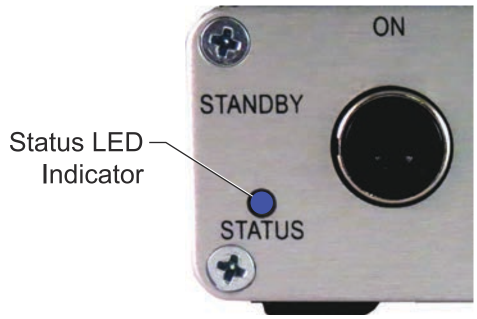


Figure 10-5. OBIS 6-Laser Remote Status LED Indicator

Table 10-2 lists the states for the LED indicator on the OBIS 6-Laser Remote.

Table 10-2. OBIS 6-Laser Remote Status LED States

MODE	LED STATUS	INTERNAL AUTO START JUMPER	KEYSWITCH POSITION	INTERLOCK STATUS
1	**Blue**	Out	STANDBY	X
2	**Blinking Blue**	Out	Fault - keyswitch in ON position at power-up	X
3	**Green**	Out	Cycle STANDBY to ON	Closed
4	**Blue**	In	STANDBY	X
5	**Green**	In	ON	Closed
6	**Red**	X	ON	Open

The conditions described above are at power ON. It is recommended that the keyswitch be in STANDBY position and the internal Auto Start jumper not be installed. This will place the OBIS Remote in **Mode 1**.

- **Mode 1**: A blue LED without the internal Auto Start jumper installed and with the keyswitch in the STANDBY position. The interlock can be either in or out because the OBIS 6-Laser Remote is not looking for the interlock plug.
- **Mode 2**: A blinking blue LED that displays when you have the keyswitch in the ON position and you power-up the OBIS 6-Laser Remote. To clear this condition, turn the keyswitch to STANDBY, then back to ON.

  NOTE: With the internal Auto Start jumper inserted, this fault mode is bypassed and defeats the laser safety feature.
- **Mode 3**: This green LED appears when you have correctly powered up the OBIS 6-Laser Remote, cycled to the ON position, there is no internal Auto Start jumper, and the interlock plug is in position.
- **Mode 4**: This is the first of the configurations that includes the Auto Start jumper. When you power-up the OBIS 6-Laser Remote and have the keyswitch in STANDBY, the LED will be blue.

- **Mode 5**: This is the correct sequence for the OBIS 6-Laser Remote when the internal Auto Start jumper is in position. The LED will be green when you power the OBIS 6-Laser Remote with the keyswitch ON and the internal Auto Start jumper on the interlock plug is connected.
- **Mode 6:** This red LED indicates that the interlock was opened with the keyswitch in the ON position.

WARNING!
When the keyswitch is in the ON position, the interlock plug is connected, and the laser power switches are in the ON position and illuminated, laser emission is possible.

Power ON/OFF Switches

The power switches for each laser are shown in Figure 10-6. Applies power to each laser. Each power switch illuminates green when power is applied.

Figure 10-6. OBIS 6-Laser Remote Power ON/OFF Switches

Back Panel

The back panel of the OBIS 6-Laser Remote (shown in Figure 10-7) has the following connectors: Main Power In, (six) Power Out and the Interlock. These connectors are described in the sections that follow.

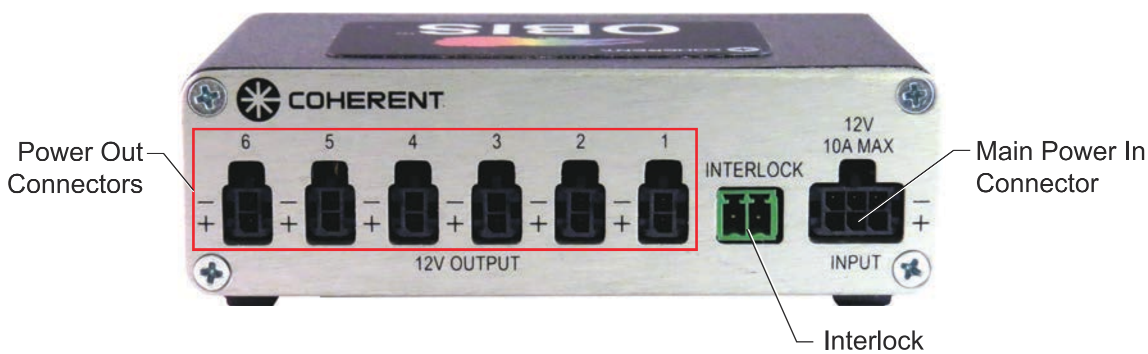


Figure 10-7. OBIS 6-Laser Remote Back Panel

Main Power In Connector

The Main Power-In Connector is shown in Figure 10-8.

A 6-pin Molex connector supplies power to the OBIS 6-Laser Remote. The Astrodyne power supply also has an ON/OFF switch to power the device.

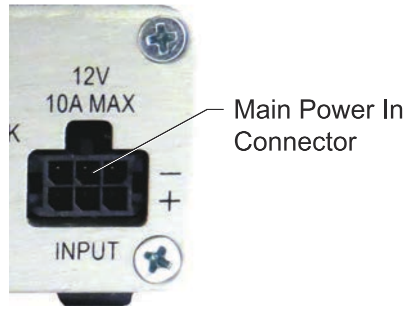


Figure 10-8. OBIS 6-Laser Remote Main Power In Connector

Power Out Connectors

Power is supplied to the lasers through six 5.5 mm 2-pin connectors: (Molex SDA43025-0200), shown in Figure 10-9. Two crimp-style contact pins are also needed (Molex 43030-0009). The cable is 1 meter.

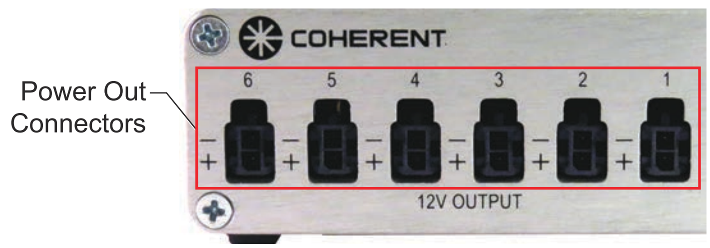
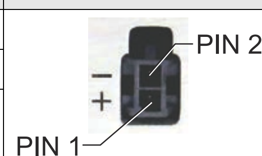


Figure 10-9. OBIS 6-Laser Remote Power Out Connectors

Table 10-3 lists the pin-outs for the Power Out connector on the OBIS 6-layer system.

Table 10-3. OBIS 6-Laser Power Out Connector Pin-out Specifications

SIGNAL NAME	PIN NUMBER	PIN LOCATIONS
Positive (+)	1	
Ground	2	

Interlock

The interlock has terminal-style connections that permit connection to an external control device.The mechanical-style jumper for the CDRH interlock, shown in Figure 10-10, is included.

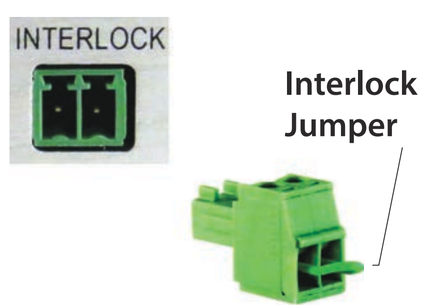


Figure 10-10. OBIS 6-Laser Remote Interlock and Interlock Jumper

Auto Start Jumper and Fuse Replacement

The Auto Start feature lets the operator start the OBIS when the laser completes its warm up and automatically starts the laser without toggling the keyswitch.

WARNING!
Enabling the Auto Start function defeats CDRH compliance.

The Auto Start jumper is inside the OBIS 6-Laser Remote. To access the jumper, remove the top four screws on the front and back covers and then remove the top cover (see Figure 10-11).

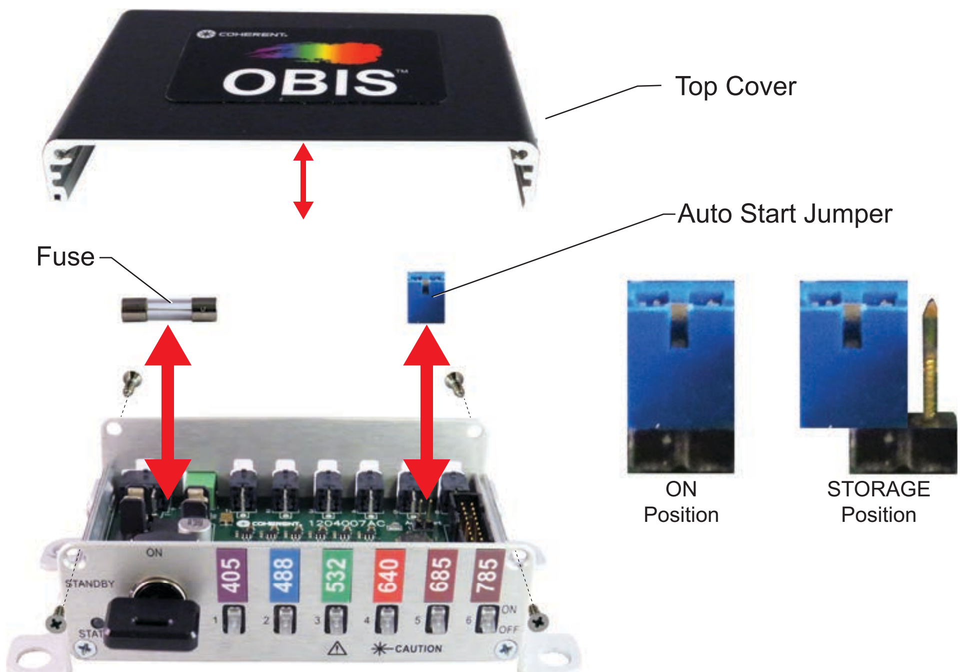


Figure 10-11. OBIS 6-Laser Remote – Exploded View

The remote jumper is at the back of the OBIS 6-Laser Remote, near the corner. The Auto Start jumper is a 100 mil shunt. To store the jumper in the OBIS 6-Laser Remote, attach the jumper to only one of the pins.

To access the 10A fuse, remove the four screws holding the front or back cover. The fuse is in the opposite corner from the Auto Start jumper. The fuse is a 10 amp, 250V, 5 x 20 mm, slo-blo fuse (Catalog #218010P).

NOTICE!
Removing the OBIS 6-Laser Remote cover to replace the fuse or set the Auto Start jumper does *not* void the unit warranty.

Remote Interlock

The OBIS 6-Laser Remote has an interlock circuit that prevents the generation of laser radiation. For more information, refer to “Remote Interlock” (p. 1-10).

Interlock Control

Connect the OBIS 6-Laser Remote to a remote switch to disable the system if a door or panel is opened. The interlock switch must be wired in series with the interlock RCA connector. 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.

Table 10-4lists laser behavior if the interlock circuit is opened during laser operation.

Table 10-4. OBIS 6-Laser Behavior during Laser Operation

KEY SWITCH	INTERLOCK CIRCUIT OPENED	INTERLOCK CIRCUIT OPENED AND CLOSED AGAIN WHILE LASER SYSTEM IS POWERED
OFF	No failure displayed.	No failure displayed.
ON	Failure displayed by red LED status on front panel. Need to close interlock circuit to clear failure status.	Red LED displayed. Keyswitch must be cycled to STANDBY and then back to ON for lasers to start lasing again.

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

Overview of the 6-Laser Remote Installation Procedure

The procedure in this section describes how to connect the OBIS Laser and OBIS 6-Laser Remote. For information about installing the laser and using the USB connection on the laser back panel for control, refer to "Section Five: Coherent Connection" (p. 5-1) and "OBIS Communications through a Terminal Program" (p. 6-5).

NOTICE!
Operating the laser without the OBIS 6-Laser Remote is non-CDRH compliant.

The installation procedure has the following steps:

1. Install the optional heatsink.
2. Mount the laser.
3. Connect power to the OBIS 6-Laser Remote.
4. Add optional fan power to the laser.
5. Connect the interlock to the OBIS 6-Laser Remote.
6. Connect the optional USB cable (sold separately) to the laser back panel.

Procedure

To connect the OBIS Laser and OBIS 6-Laser Remote:

1. Install the optional heatsink (p. 3-1).
2. Mount the laser (p. 3-4).
3. Connect the power cord to the OBIS 6-Laser Remote, as shown in Figure 10-12.

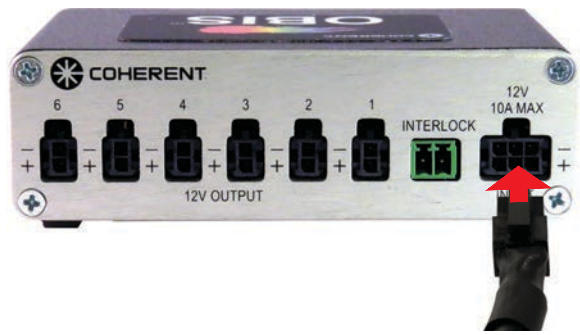


Figure 10-12. OBIS 6-Laser Remote Connecting Power

The Coherent OBIS Laser System includes a power supply (that has a Power ON indicator).

4. Add optional fan power to the laser (p. 3-7)
5. Connect the Interlock jumper to the OBIS 6-Laser Remote, as shown in Figure 10-13. For interlock details and specifications, refer to "Interlock Control" (p. 10-8).

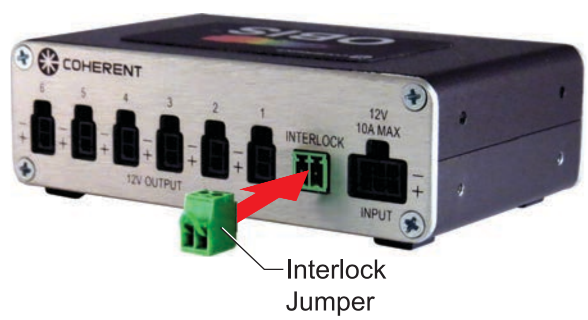


Figure 10-13. OBIS 6-Laser Remote Connecting the Interlock Jumper

6. Connect the optional USB cable (sold separately) to the laser back panel.

Dimensions

Figure 10-14 shows the dimensions for an OBIS 6-Laser Remote.

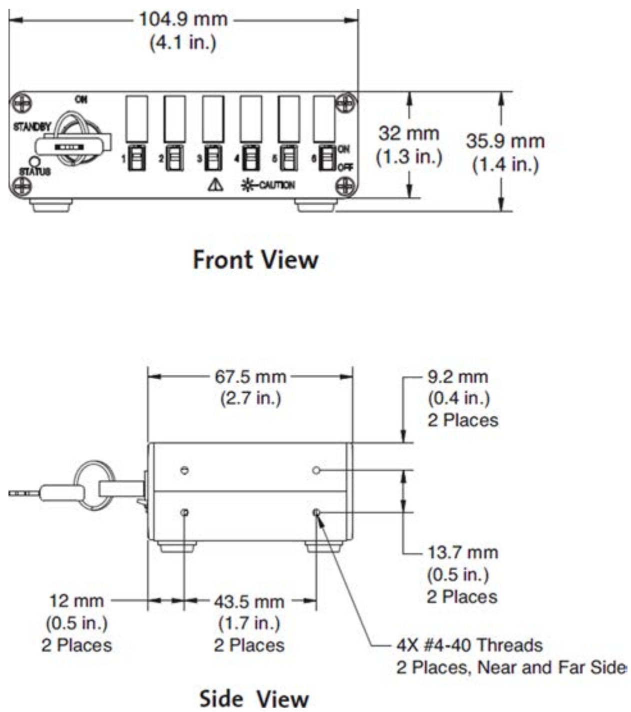


Figure 10-14. OBIS 6-Laser Remote Dimensions

Figure 10-15 shows the dimensions for a Power Supply for the OBIS 6-Laser Remote.

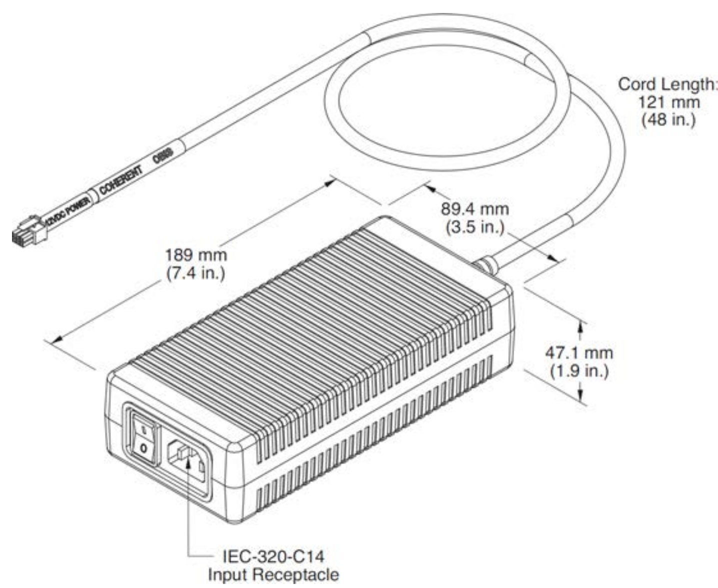


Figure 10-15. OBIS 6-Laser Remote Power Supply Dimensions

For the latest drawing dimensions and product details, see:

https://www.coherent.com/lasers/laser/obis-accessories/obis-6-laser-remote

Specifications

Table 10-5 lists the specifications for the OBIS 6-Laser Remote.

Table 10-5. OBIS 6-Laser Remote Specifications

PARAMETER	SPECIFICATION
Remote dimensions	68 x 105 x 33 mm
Laser Out connectors	Six @ 12VDC 1.5A
Operating temperature range	0 to 50°C
Operating humidity range (non-condensing)	30 to 85%
Storage temperature range	-20 to 70°C
Storage humidity range (non-condensing)	30 to 95%
Interlock(s)	One keyswitch One dual pin
Power input	12V ± 2V DC @ 10A
Mechanical expandability	Yes

For the latest specifications, see:

https://www.coherent.com/lasers/laser/obis-accessories/obis-6-laser-remote

Repacking Procedure

Refer to “OBIS Repacking Procedure” (p. 9-3).

Troubleshooting Procedures

Table 10-6 lists possible problems, with a reference to the related troubleshooting checklist.

Table 10-6. OBIS 6-Laser Remote Troubleshooting Procedures

PROBLEM	REFERENCE
There is no output power from the laser.	Checklist 1 (p. 10-12)

This troubleshooting checklist is described next.

Checklist 1: There is no output power from the laser.

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

[ ] Confirm the Power Supply connector is securely fastened to the OBIS 6-Laser Remote.

[ ] Verify the green, two-pin interlock is firmly seated and is not loose.

[ ] Check that each power cord connection between the OBIS Laser and the 6-Laser Remote Power Out connectors is securely fastened.

[ ] Cycle laser power ON/OFF by toggling the power switch to the OFF position and then back to the ON position. When in the ON position, the toggle switch will be green.
Note: There are six independent ON/OFF toggle switches—confirm the correct power switch is in the ON position and illuminated for the correct OBIS Laser channel.

[ ] Toggle the Keyswitch to the STANDBY position and then back to the ON position. The Keyswitch acts as the CDRH Manual Reset. After an interlock fault or power interruption, the laser will not auto restart until the Keyswitch is set to the STANDBY position and then back to the ON position—refer to Figure 10-3 (p. 10-3).

[ ] Refer to Table 10-2 (p. 10-4) for a description of the LED Status indicator Modes. Also refer to Table 10-4 (p. 10-8) for the OBIS 6-Laser Remote behavior during laser operation.

[ ] Check the operating mode of the laser by using the Coherent Connection application software or the remote command SOUR:AM:SOUR? For normal CW mode, the laser must be in the “CW Power” mode from Coherent Connection or should reply with “CWP” when you send a query for the set operating mode of the laser.

[ ] Remove the OBIS 6-Laser Remote cover and check the fuse. If the fuse needs replacement, use a 10 amp, 250V, 5 x 20 mm, slow-blow fuse (Catalog #218010P). Refer to Figure 10-11 (p. 10-7) for location of the fuse and the cover screws.

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

SECTION ELEVEN: OBIS SCIENTIFIC REMOTE

In this section:

Figure 11-1 shows the components and accessories included with the OBIS Scientific Remote system.

Figure 11-1. OBIS Scientific Remote System Components and Accessories

See information about the OBIS Scientific Remote on the Coherent website at:

https://www.coherent.com/lasers/laser/obis-accessories/obis-scientific-remote

For current specifications, see:

https://cohrcdn.azureedge.net/assets/pdf/OBIS-Scientific-Remote-Data-Sheet.pdf

Table 11-1 lists the components and accessories for the OBIS Scientific Remote system.

Table 11-1. OBIS Scientific Remote System Components and Accessories

ITEM	DESCRIPTION	PART NUMBER
1	OBIS Scientific Remote: OBIS Scientific Remote OBIS Scientific Remote with six Laser-to-Remote SDR cables included (1 meter each)	1234465 1234466
2	Cable, SDR, laser to OBIS Scientific Remote (1 meter) (6 each)	1179451
3	Keys for OBIS Scientific Remote (2 each)	See P/N 1190348 in Table B-1 (p. B-1)
4	Interlock, shorted, for OBIS Scientific Remote	
5	USB memory drive (application software and user documentation)	
7	Wavelength labels for OBIS Scientific Remote	
8	OBIS Laser Safety and Installation Quick Start Guide	1185449
6	OBIS LX/LS Operator's Manual (PDF file on USB memory drive)	1184163

Description

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

The OBIS Scientific Remote for OBIS LX/LS offers all the features from the laser in a convenient CDRH-compliant interface with a touch-screen and internal power supply for up to six lasers.

As with all OBIS LX/LS lasers, the laser itself offers a stand-alone all-in-one laser solution. The OBIS Laser comes with a Power Connection, USB Connection, Fan Connection and a SDR-type Connection for laser control I/O. All of these connectors are on the back panel of every OBIS LX/LS laser.

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

OBIS Scientific Remote has a convenient handle to angle the unit for easier display.

Front Panel

Features on the OBIS Scientific Remote front panel are shown in Figure 11-2. Each feature is described in the following subsections.

Interactive Touch Screen

Use the touch screen to set up, monitor and control all lasers that are attached to the OBIS Scientific Remote.

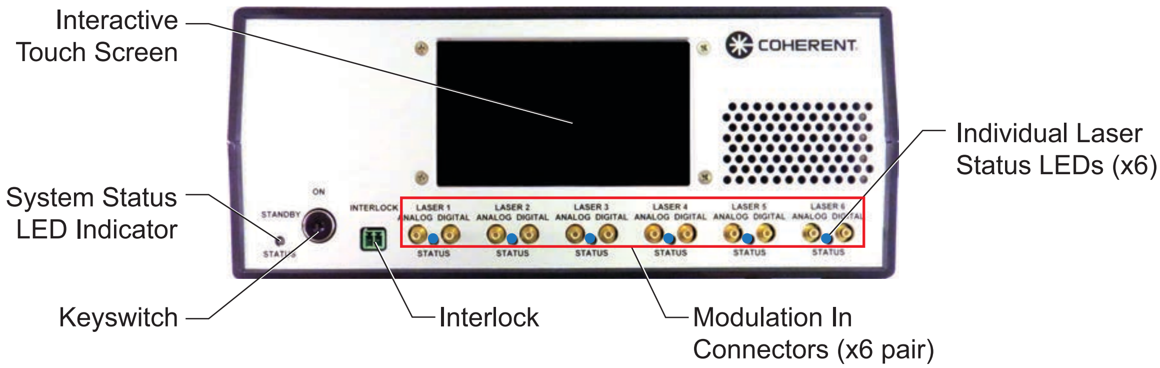


Figure 11-2. OBIS Scientific Remote Front Panel

System Status LED Indicator

The System Status LED indicator is located on the front panel, as shown in Figure 11-3. This LED indicator displays yellow, green, blue or red. The state of the OBIS Scientific Remote calculates the color and is described, below.

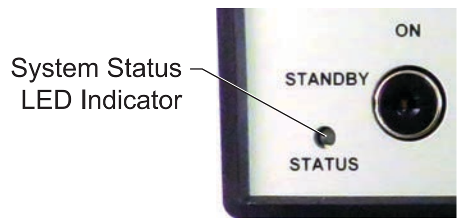


Figure 11-3. OBIS Scientific Remote System Status LED Indicator

Table 11-2 lists the states for the LED indicator on the OBIS Scientific Remote.

Table 11-2. OBIS Scientific Remote Status LED States

MODE	LED STATUS	AUTO START	KEYSWITCH POSITION	INTERLOCK STATUS
1	**Blue**	Disabled	STANDBY	X
2	**Blinking Blue**	Disabled	ON at power-up	X
3	**Green**	Disabled	Cycle STANDBY to ON	Closed
4	**Blue**	Enabled	STANDBY	X
5	**Green**	Enabled	ON	Closed
6	**Red**	X	ON	Open

The conditions described above are at power ON.

- **Mode 1**: A blue LED with Auto Start disabled and the keyswitch in the STANDBY position. The interlock can be either in or out because the OBIS Scientific Remote is not looking for the interlock plug.
- **Mode 2**: A blinking blue LED that displays when you have the keyswitch in the ON position and you power-up the OBIS Scientific Remote. To clear this condition, turn the keyswitch to STANDBY, then back to ON.
- **Mode 3**: This green LED appears when you have correctly powered up the OBIS Scientific Remote, cycled to the ON position, Auto Start is disabled, and the interlock plug is in position.

- **Mode 4**: This is the first of the configurations that includes Auto Start. When you power-up the OBIS Scientific Remote and have the keyswitch in STANDBY, the LED will be blue.
- **Mode 5**: This is the correct sequence for the OBIS Scientific Remote when Auto Start is enabled. The LED will be green when you power the OBIS Scientific Remote with the keyswitch ON and the Auto Start is enabled.
- **Mode 6**: This red LED indicates that the interlock was opened with the keyswitch in the ON position.

Keyswitch

The OBIS Scientific Remote has a keyswitch (see Figure 11-4).

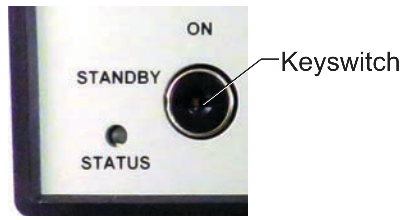


Figure 11-4. OBIS Scientific Remote Keyswitch

This keyswitch prevents the generation of laser radiation when in the STANDBY position. The keyswitch is the CDRH Manual Reset feature.

WARNING!
Laser emission can occur when the keyswitch is in the ON position, the interlock plug is connected, and the laser Start/Stop button is enabled.

The key is removable in the STANDBY position, but not in the ON position.

After an interlock fault or power interruption, the laser does not automatically restart unless the keyswitch is first reset to the STANDBY position, then returned to the ON position, as shown in Figure 11-5.

Figure 11-5. OBIS Scientific Remote Keyswitch STANDBY and ON Positions

Interlock

The interlock has terminal-style connector, shown in Figure 11-6, that permits integration with an external control device or interlock circuit. The mechanical-style jumper for CDRH interlock is included.

Figure 11-6. OBIS Scientific Remote Interlock

Modulation In Connectors

There are six sets of SMB connectors (one digital and one analog per set), as shown in Figure 11-7.

Figure 11-7. OBIS Scientific Remote Modulation In Connectors

These connectors connect to buffer amplifiers within the OBIS Scientific Remote and are converted to differential signals to pass through the SDR cables to the lasers. The input impedance of the digital input is 50 ohms and the analog input impedance is 2000 ohms.

Individual Laser Status LEDs

Each of the six Status LED indicators displays the status of one laser that is connected to a specific Modulation In connector. The LED colors for the various states are listed in Table 11-3.

Table 11-3. OBIS Scientific Remote Individual Laser Status LED States

LED Color	State
Blue	Standby
Blinking Green	Warm Up
White	Emitting
Red	Fault

Back Panel

The back panel of the OBIS Scientific Remote is shown in Figure 11-8:

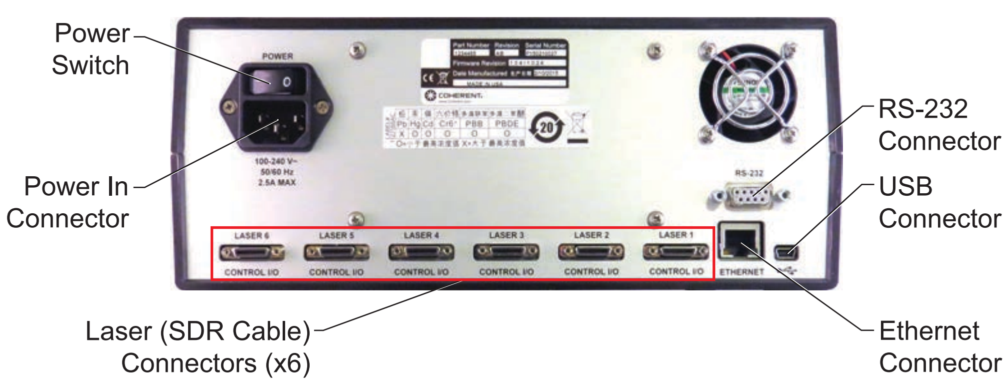


Figure 11-8. OBIS Scientific Remote Back Panel

This panel includes the following switches and connectors. These switches and connectors are described next.

- Power switch
- Power In connector
- Laser (SDR cable) connectors
- Ethernet connector
- USB connector
- RS-232 connector

Power Switch

Toggle power between OFF and ON to the OBIS Scientific Remote.

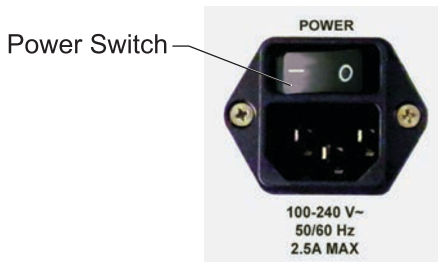


Figure 11-9. OBIS Scientific Remote Power Switch

Power In Connector

Power is supplied to the OBIS Scientific Remote through an IEC-320 AC connector.

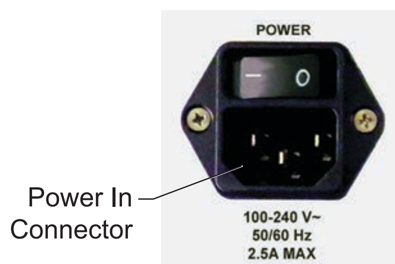


Figure 11-10. OBIS Scientific Remote Power In Connector

Laser (SDR Cable) Connectors

Use these connectors to connect a SDR cable between the laser and the OBIS Scientific Remote. Type: 3M 12226-8250-00FR.

Figure 11-11. OBIS Scientific Remote Laser (SDR Cable) Connectors

Refer to “Appendix B: OBIS Accessories Parts List” (p. B-1) for a complete list of cable part numbers.

USB Connector

This is a standard Mini-B connector, shown in Figure 11-12, used to make connection to a PC for remote control of the laser. For more information about setting up an USB connection, refer to “OBIS Communications through a Terminal Program” (p. 6-5).

Figure 11-13 shows the location of the connector for the USB cable.

Figure 11-12. OBIS Scientific Remote USB Connector

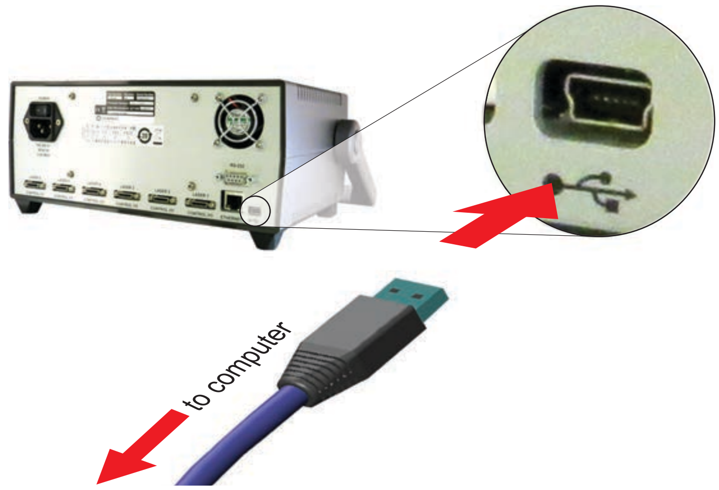


Figure 11-13. OBIS Scientific Remote USB Connector Location

RS-232 Connector

Attach an RS-232 cable between this DB9F RS-232 connector and the RS-232 connector on a host computer to send commands through a SDR connector. For more information about setting up a RS-232 connection, refer to “OBIS Communications through a Terminal Program” (p. 6-5).

Figure 11-14. OBIS Scientific Remote RS-232 Connector

Figure 11-15 shows the location of the connector for the RS-232 cable.

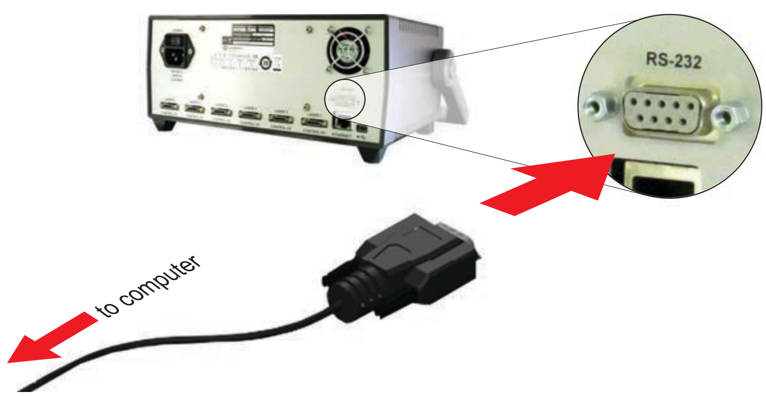


Figure 11-15. OBIS Scientific Remote RS-232 Connector Location

Table 11-4 lists the RS-232 communication settings for the OBIS Scientific Remote.

Table 11-4. OBIS Scientific Remote RS-232 Communication Settings

SETTING	VALUE
Baud	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Table 11-5 on page 11-8 lists the RS-232 pin-outs for the OBIS Scientific Remote.

Table 11-5. OBIS Scientific 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)		

Ethernet Connector

Figure 11-16 shows the RJ-45 Ethernet connector. Use this to make connection between the OBIS Scientific Remote and a network or a hub on a network for remote control of the laser.

Figure 11-16. OBIS Scientific Remote Ethernet Connector

Figure 11-17 shows the location of the Ethernet connection for a network cable.

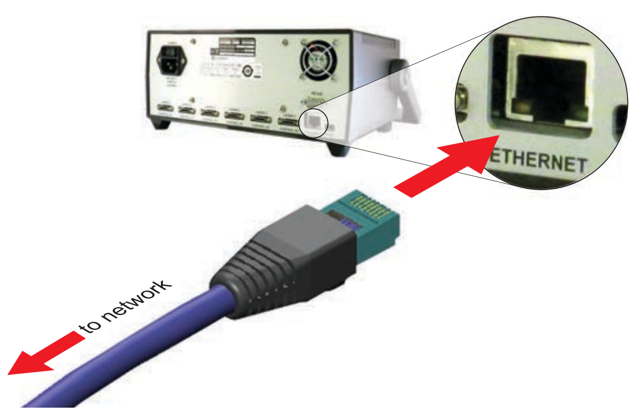


Figure 11-17. Ethernet Cable from the OBIS Scientific Remote to the Network

After connecting the Scientific Remote to a PC, use the following procedure to configure Ethernet network communication.

Establish Ethernet Communication with the OBIS Scientific Remote

After connecting the Scientific Remote to a PC (see Figure 11-17), use Coherent Connection to configure Ethernet network communication.

1. Configure the Scientific Remote, as shown in Figure 11-18.

   A Scientific Remote may be configured to accept or refuse remote connections via Ethernet. This is controlled via the Network tab from the Settings button.

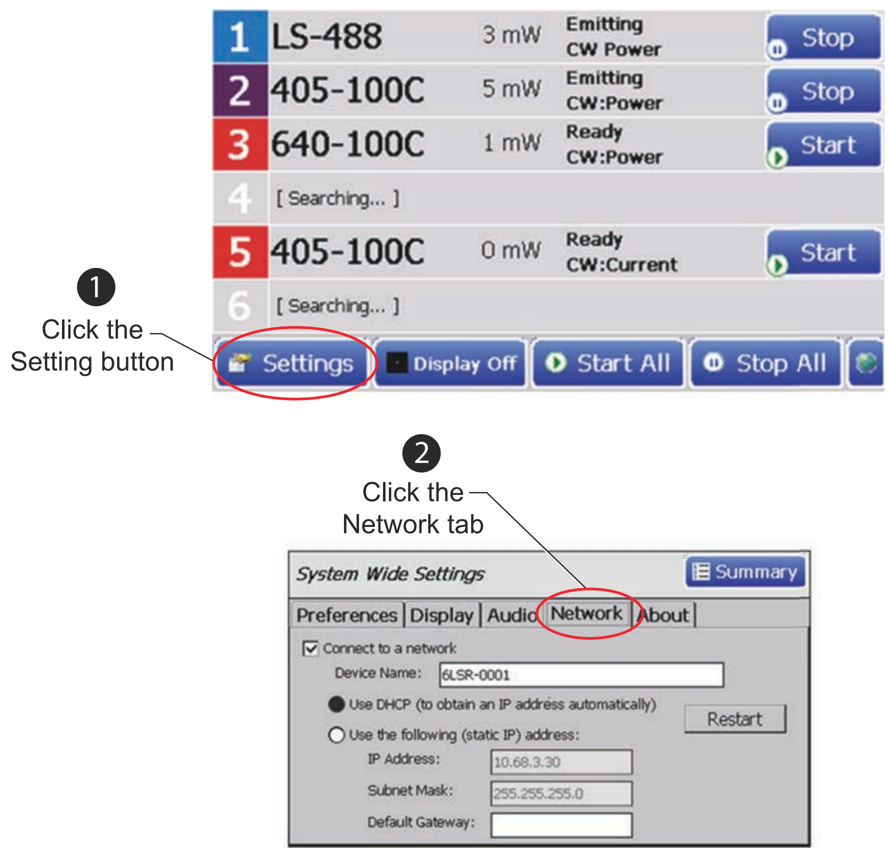


Figure 11-18. Configure the OBIS Scientific Remote

   In the above example, the Scientific Remote is configured for network access. The following items are necessary for the Scientific Remote to accept remote connections via Ethernet:

   - The *Connect to a network* check box must be checked.
   - The *Device Name* must be unique on your LAN. Note that since devices are shipped from the factory with a unique name that incorporates a serial number, you should never have to change it.
   - One of the two radio buttons must be selected
     - *DHCP* is the simplest to configure.
     - If *Static IP Address* is selected, make sure to fill in the three fields (*IP Address*, *Subnet Mask*, and *Default Gateway*). Contact your system administrator to obtain a valid static IP address.

2. Connect the Scientific Remote to the same local area network (LAN) as the computer running the Coherent Connection software.

Generally this means connecting the remote to a suitable network hub via an Ethernet cable. ***Remote control only works between devices on the same LAN***.

3. Launch Coherent Connection on your computer.
4. Open the Manage Network Devices dialog from the Main menu, shown in Figure 11-19.

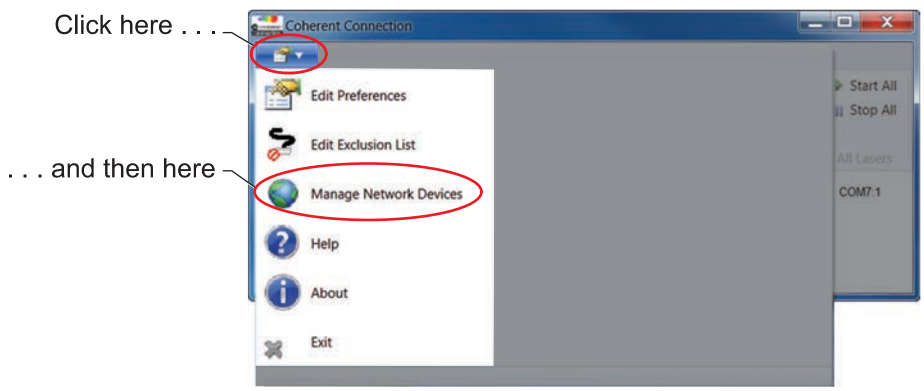


Figure 11-19. Manage Network Devices Option

5. Press the **Search For New Devices** button, shown in Figure 11-20.

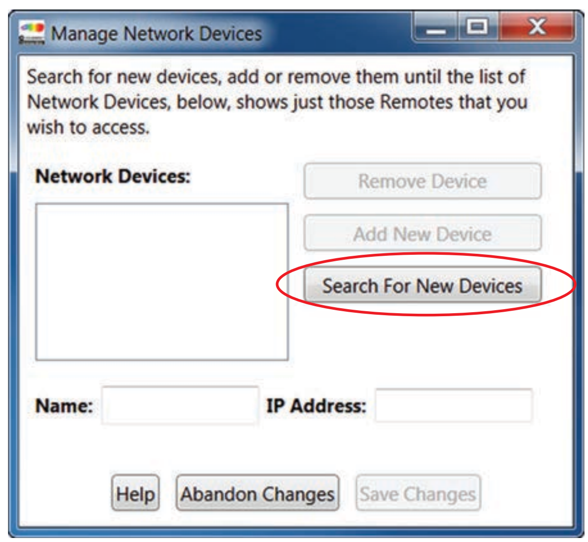


Figure 11-20. Search for New Devices Option

The OBIS Scientific Remote should appear in the *Network Devices* list, which verifies that the Ethernet connection is established. If the OBIS Scientific Remote does not appear in the list, use the following instructions to manually establish a network connection.

Manually Add a Scientific Remote to Network Devices

Figure 11-21 shows the steps to manually add an OBIS Scientific Remote to the list of Network Devices.

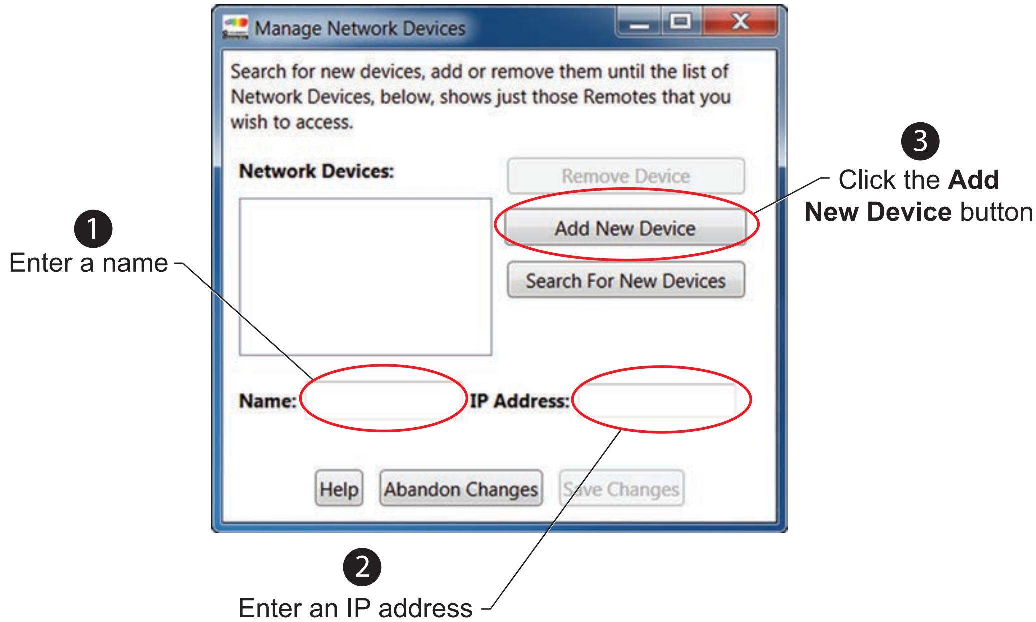


Figure 11-21. Manually Add a Scientific Remote to Network Devices

Remove a Scientific Remote from Network Devices List

Use the instructions shown in Figure 11-22 to remove an OBIS Scientific Remote from the Network Devices list.

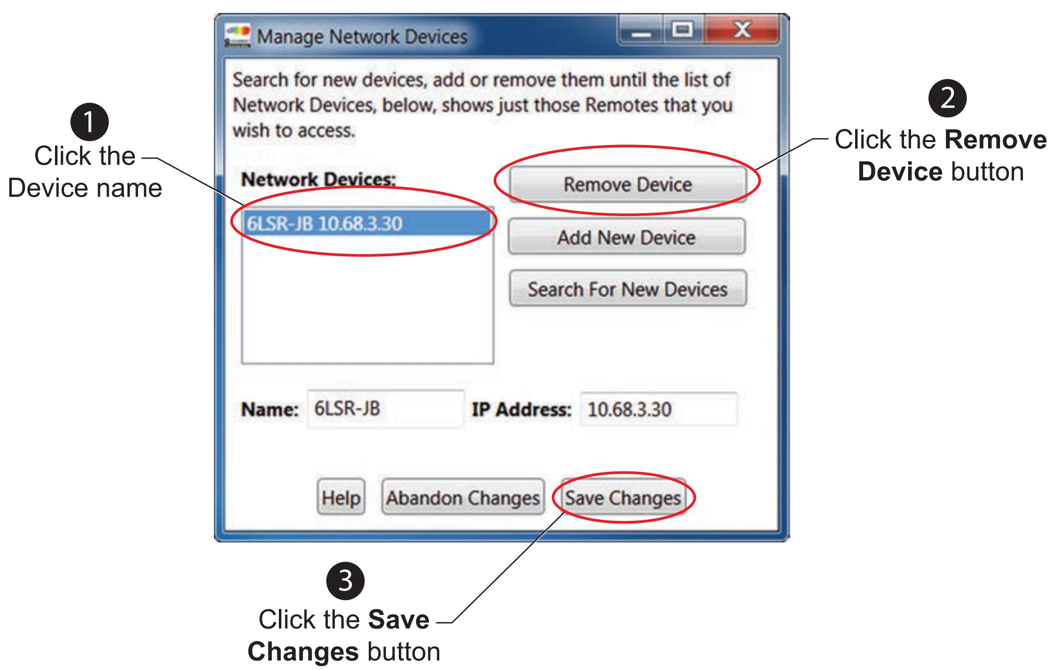


Figure 11-22. Remove a Scientific Remote from Network Devices List

NOTES:

- While the dialog is open, you can freely add or remove devices until the list includes all the Remotes you want to access.
- Other Remotes may also appear, and, as a courtesy to their intended users, you should remove them from your list. Note that after you remove an item, the item name and address are left in the text boxes. That allows you to edit an existing entry by removing it, changing the name or address, and then adding it back in with new parameters.
- Once you click the **Save Changes** button, any Remotes that were added will appear in the main window. Likewise, any Remotes that were removed will disappear (if they were active before launching the dialog).
- Pressing the **Abandon Changes** button (rather than the **Save Changes** button) will discard any pending changes and return to whatever device list was in effect when you opened the dialog.

Device Exclusion List

The Coherent Connection software continually examines all possible ports (serial, USB, and Ethernet) for the presence of compatible Coherent devices (including a Scientific Remote). When a device is found, it is added to the *Included Ports* list. A device is automatically removed from the list when it is disconnected.

There are circumstances when a user might not want the software to communicate with a certain port. Set that up using the Device Exclusion List, shown in Figure 11-23.

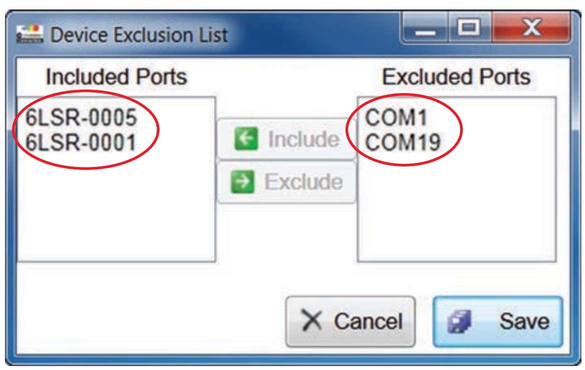


Figure 11-23. Device Exclusion List

This menu lists all ports in the user's system and allows them to be designated as *Included* or *Excluded*. Excluded ports are ignored by the software.

- The names for Ethernet-capable Remotes match the "network name" assigned to them. This is the same as the "Device Name" in the Network Settings dialog box.
- The names for USB and RS-232 devices start with "COM".

Interlock Control

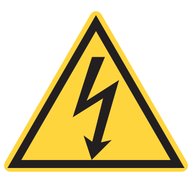
Connect the OBIS Scientific Remote to a remote switch to disable the system if a door or panel is opened. *Wire the interlock switch in series with the interlock connector*. The user has the option of connecting an external LED in series with the interlock circuit (which supplies a current source with 20 mA and a maximum of 9V).

Table 11-6 lists the laser behavior during laser operation, when:

- The interlock circuit is opened during laser operation.
- Te interlock circuit opens and closes again while the laser system is powered.

Table 11-6. OBIS Scientific Remote Behavior During Laser Operation

	KEY SWITCH	
	OFF	**ON**
Interlock Circuit Opened		
	No failure displayed.	Failure displayed by red LED status on front panel. Close interlock circuit to clear failure status.
Interlock Circuit Opened and Closed Again While Laser System is Powered		
	No failure displayed.	Red LED displayed. Keyswitch must be cycled to STANDBY and then back to ON for lasers to start lasing again.



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

Scientific Remote Installation Procedure

The procedure in this section describes how to connect the OBIS Laser and OBIS Scientific Remote. For information about installing the laser *without* the OBIS Scientific Remote, refer to “OBIS Communications through a Terminal Program” (p. 6-5).

NOTICE!
Operating the laser without the OBIS Scientific Remote is non-CDRH compliant.

The installation procedure has the following steps:

1. Install the optional heatsink.
2. Mount the laser.
3. Connect the SDR cable between the laser and the OBIS Scientific Remote.
4. Connect power to the OBIS Scientific Remote.

5. Add optional fan power to the laser.
6. Connect the interlock jumper to the OBIS Scientific Remote.
7. Connect optional USB/RS-232/Ethernet cables (for remote control).

Procedure

To install the OBIS Scientific Remote:

1. Install the optional heatsink (p. 3-1).
2. Mount the laser (p. 3-4).
3. Connect the 26-pin SDR connector to the laser and the OBIS Scientific Remote, as shown in Figure 11-24. Refer to Table 7-2 (p. 7-4) for pin assignment and functions.

Figure 11-24. OBIS Scientific Remote – Connect the SDR Cable

4. Connect the power cord to the OBIS Scientific Remote, as shown in Figure 11-25.

Figure 11-25. OBIS Scientific Remote – Connect Power

The OBIS Scientific Remote includes an internal power supply which provides power for up to six OBIS lasers through the SDR cable connection. The input voltage to the OBIS Scientific Remote is 264 VAC, 47 to 63 Hz.

5. Add optional fan power to the laser (p. 3-7).
6. Connect the interlock jumper to the OBIS Scientific Remote, as shown in Figure 11-26. For interlock details and specifications, refer to “Interlock Control” (p. 11-13).

Figure 11-26. OBIS Scientific Remote – Connect Interlock Jumper

7. Connect optional USB/RS-232/Ethernet cables (for remote control), as shown in Figure 11-27.

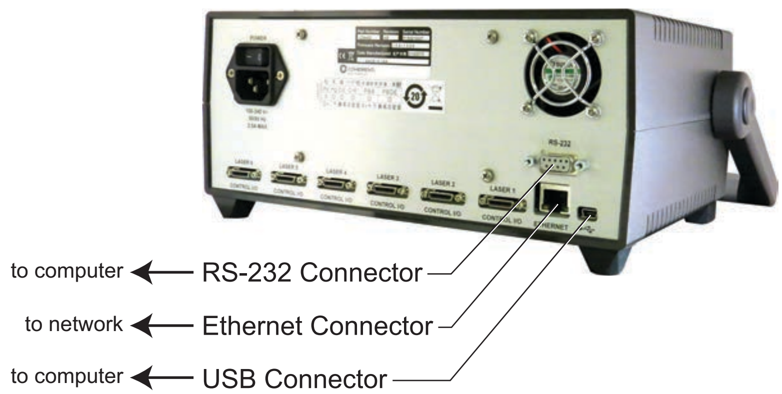


Figure 11-27. OBIS Scientific Remote – Connect Cables

Computer Control

This section describes the OBIS Scientific Remote user interface (a touch screen).

Principal User Interface Modes

The principal user interface modes are shown in Figure 11-28.

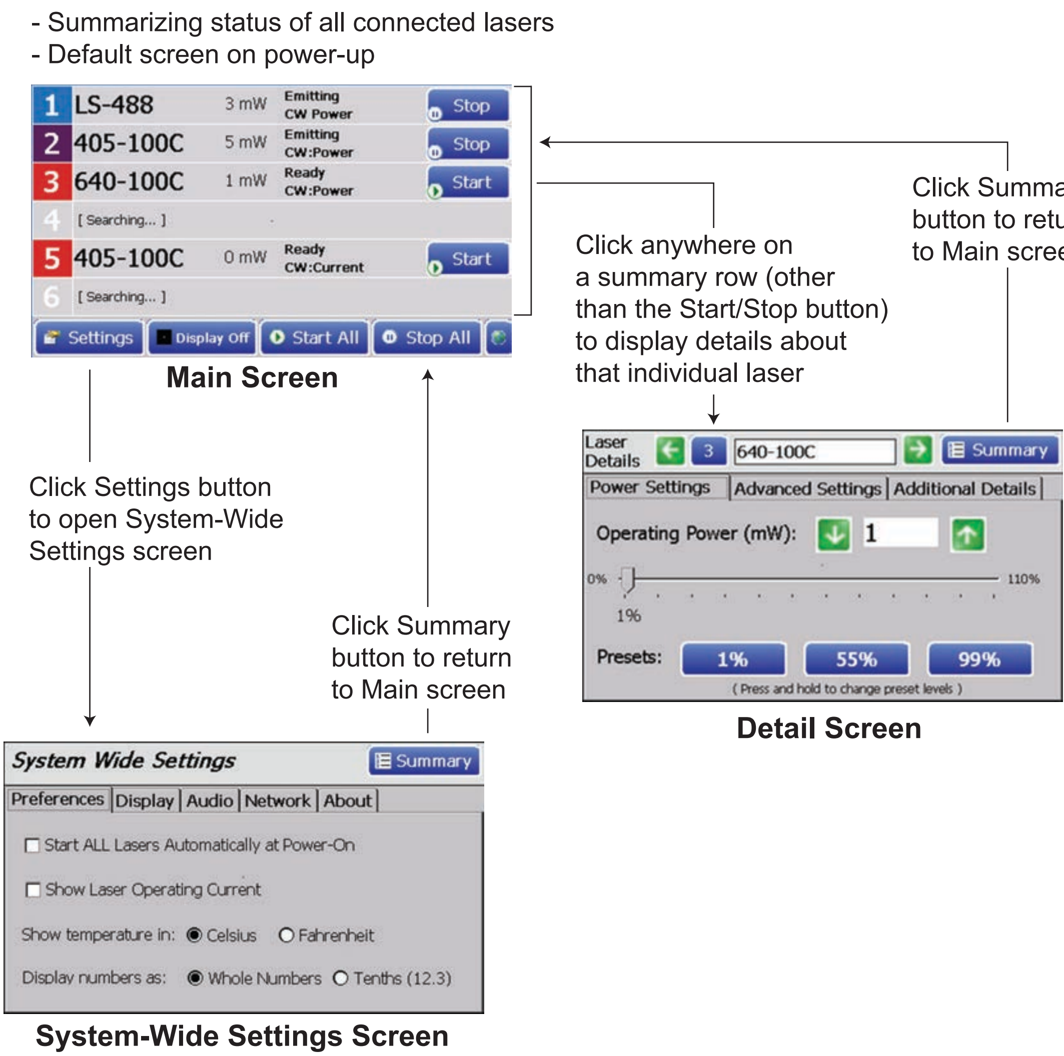


Figure 11-28. OBIS Scientific Remote – Interface Modes

Toggle Keyswitch Reminder

The dialog box shown in Figure 11-29 is displayed at system start-up if:

- Auto Start is enabled, AND
- The keyswitch is in the ON position (not in STANDBY)

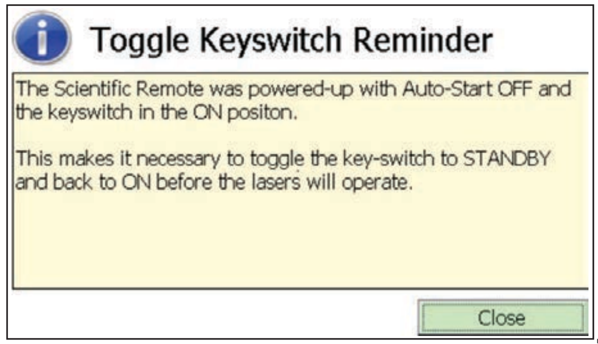


Figure 11-29. OBIS Scientific Remote – Toggle Keyswitch Reminder

To remove the dialog box:

- Press the **Close** button, or
- Turn the keyswitch to STANDBY

To bypass the safety:

- Toggle the keyswitch (which turns on all lasers) OR
- Manually turn on each laser

Main Screen

The Main Screen for the OBIS Scientific Remote user interface is shown in Figure 11-30.

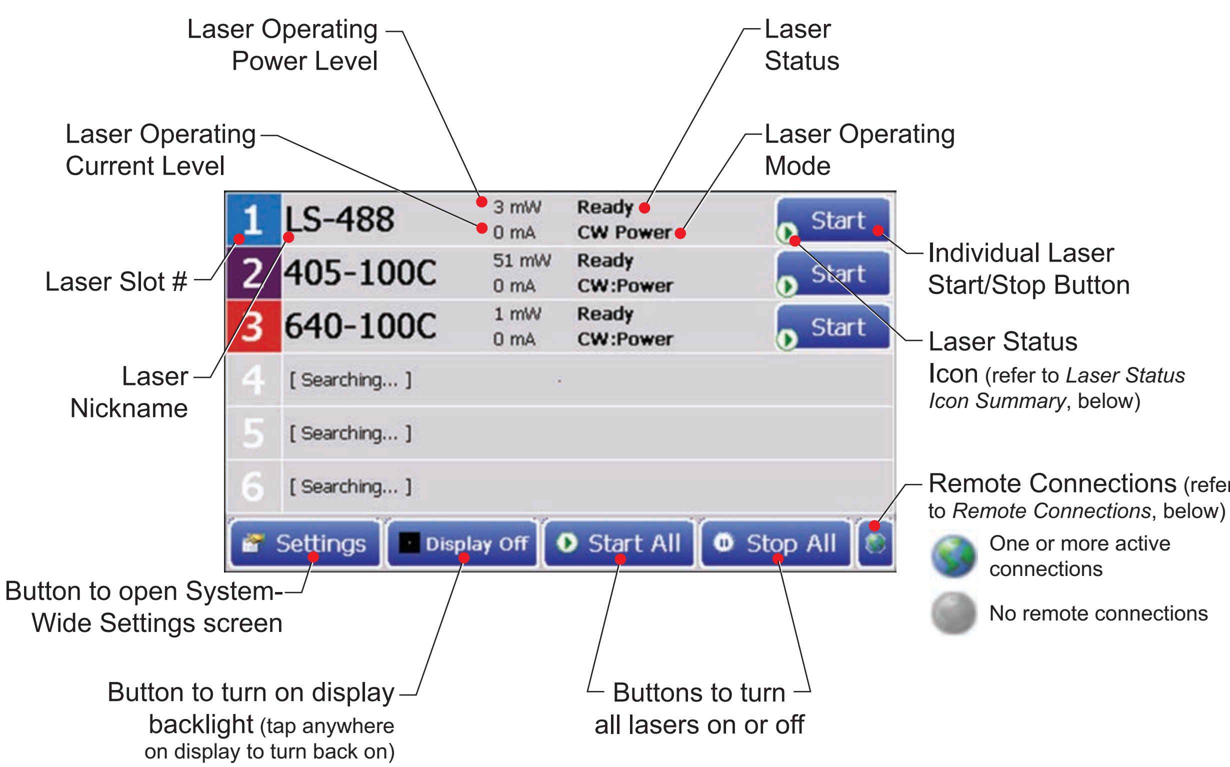


Figure 11-30. OBIS Scientific Remote – Main Screen

Laser Status Icon Summary

The icons shown in Figure 11-31 can be displayed on each laser **Start/Stop** button:

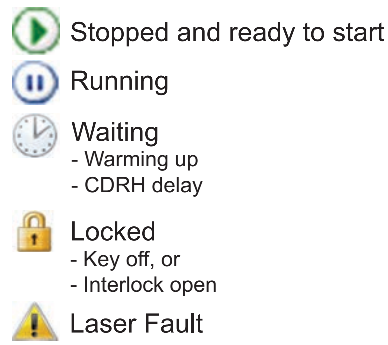


Figure 11-31. OBIS Scientific Remote – Laser Status Icon Summary

Remote Connections

Press the **Remote Connection** button on the Main Screen to access the dialog box shown in Figure 11-32:

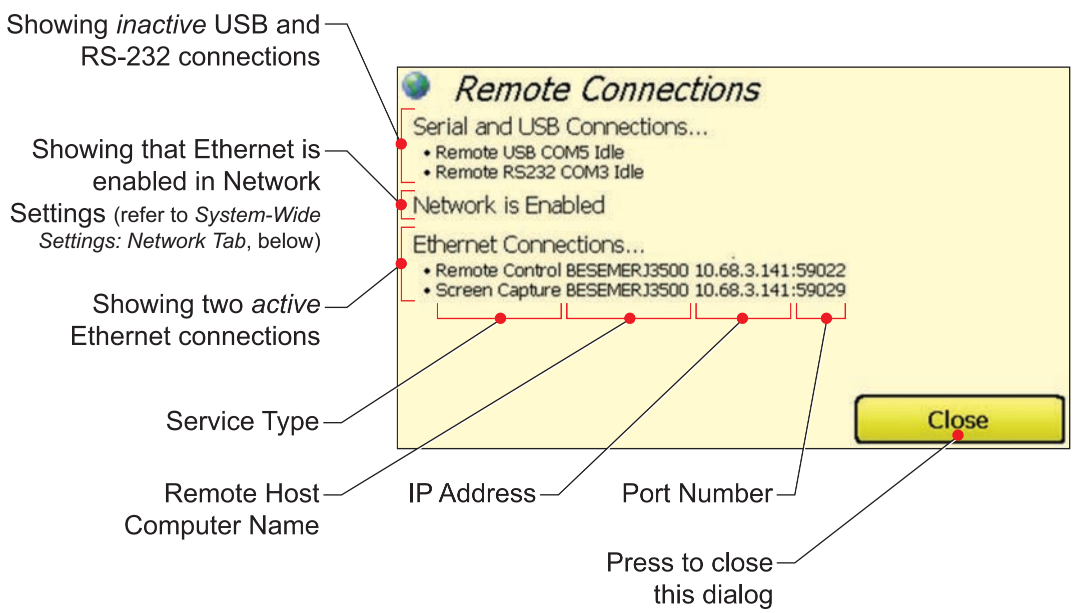


Figure 11-32. OBIS Scientific Remote – Button for Remote Connections

System-Wide Settings: Preferences Tab

Press the **Settings** button on the Main screen and then click the **Preferences** tab to access the menu shown in Figure 11-33.

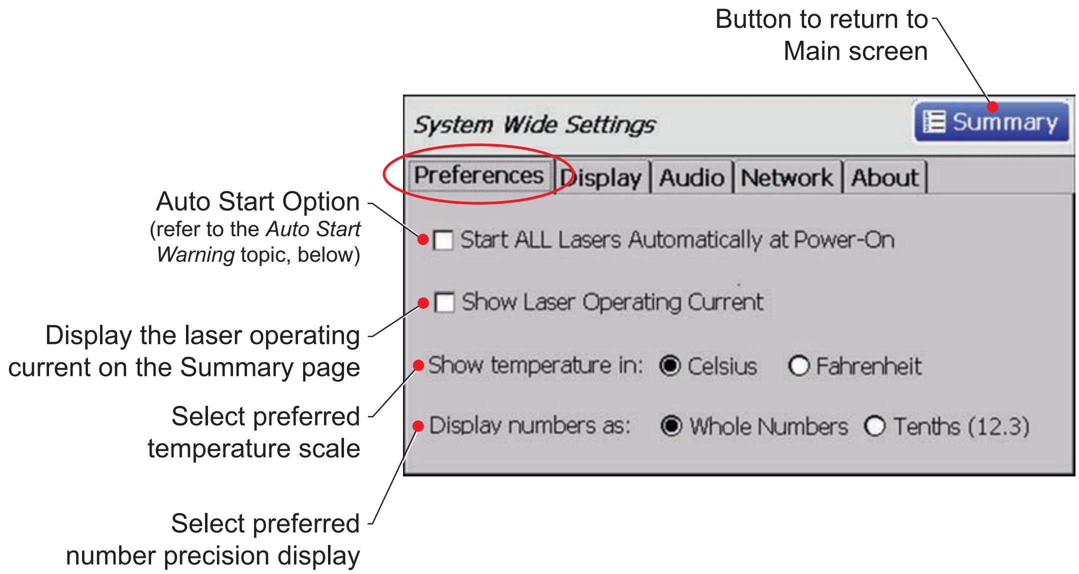


Figure 11-33. OBIS Scientific Remote – System-Wide Settings Preferences Tab

Auto Start Warning

The dialog box shown in Figure 11-34 is displayed when you select the Auto Start option on the Preferences tab of the System-Wide Settings screen:

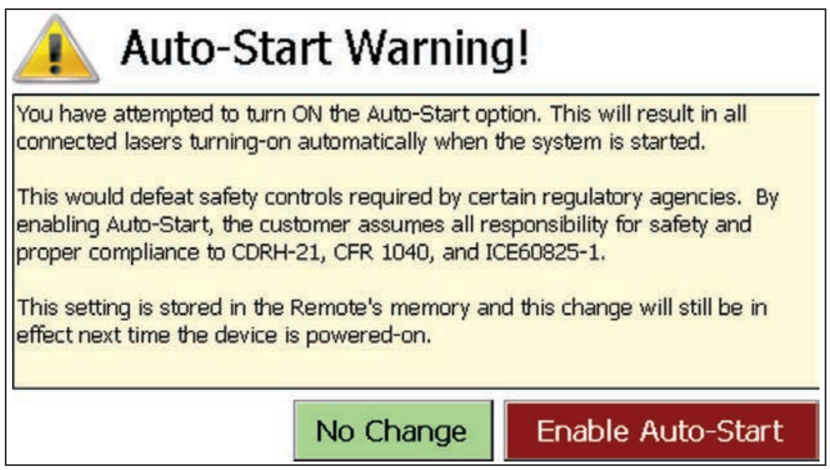


Figure 11-34. OBIS Scientific Remote – Auto Start Warning

- Click the No Change button to maintain current laser start-up settings.
- Click the Enable Auto Start button to enable Auto-Start.

CAUTION!
Enabling Auto Start defeats safety controls. Take the necessary precautions to avoid laser emissions.

System-Wide Settings: Display Tab

Press the **Settings** button on the Main screen, and then click the **Display** tab to access the menu shown in Figure 11-35.

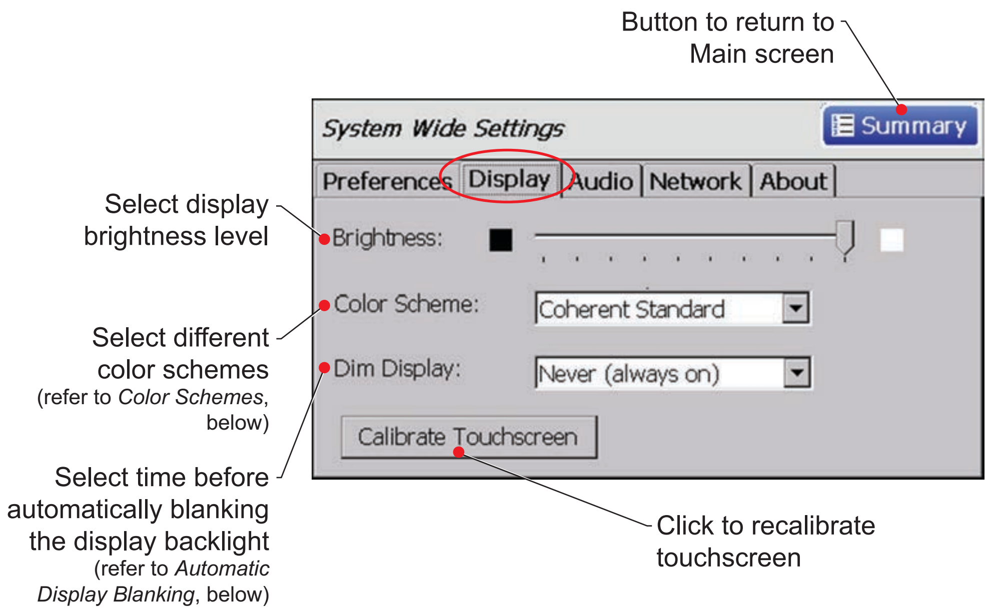


Figure 11-35. OBIS Scientific Remote – System-Wide Settings: Display Tab

Color Schemes

Color schemes for the OBIS Scientific Remote System are shown in Figure 11-36:

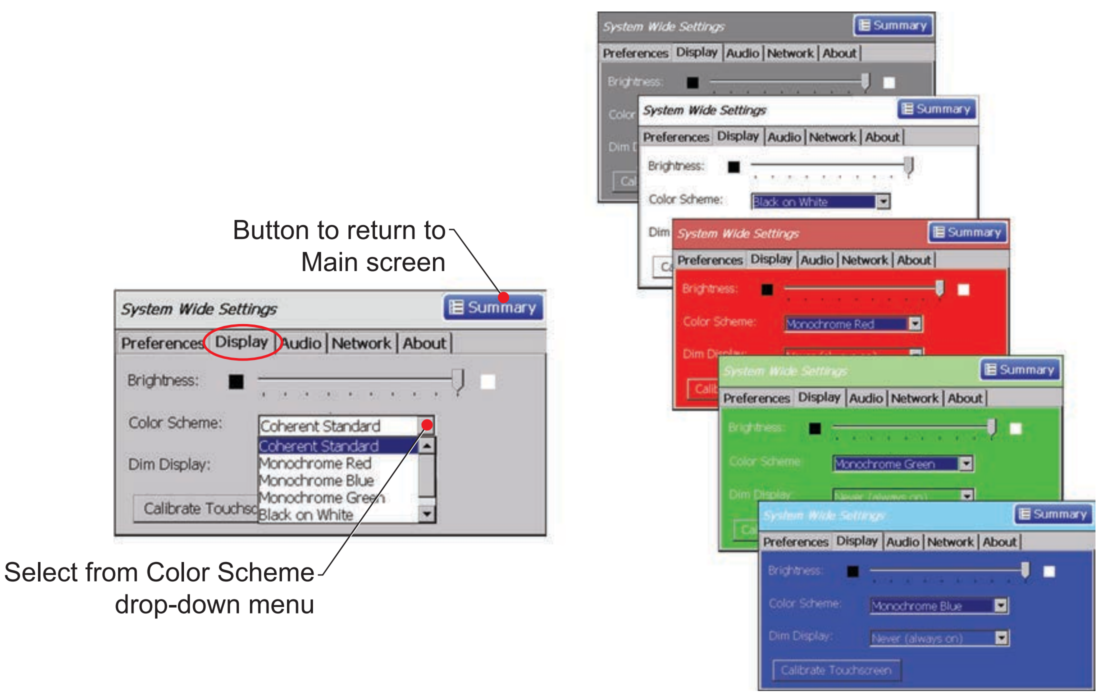


Figure 11-36. OBIS Scientific Remote – Color Schemes

Automatic Display Blanking

Settings for Blanking are shown in Figure 11-37:

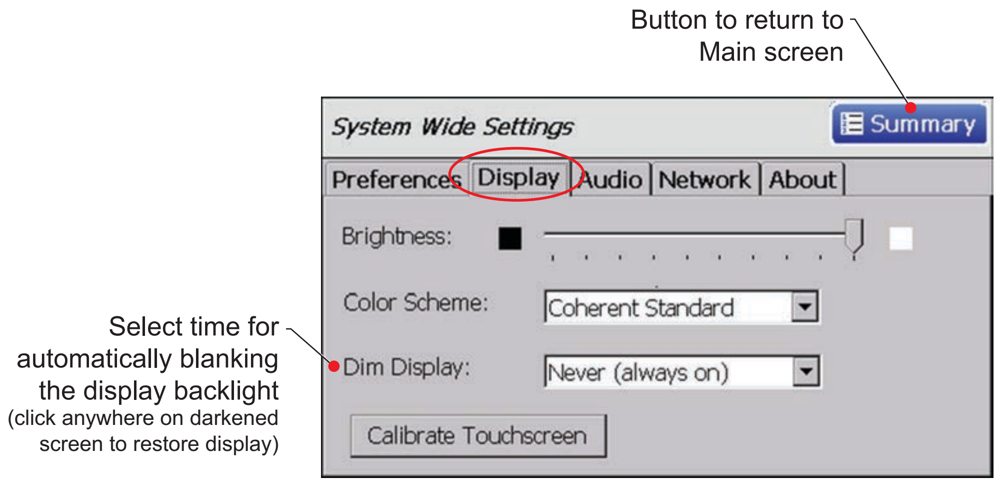


Figure 11-37. OBIS Scientific Remote – Automatic Display Blanking

System-Wide Settings: Audio Tab

Press the **Settings** button on the Main screen and then click the **Audio** tab to access this menu, shown in Figure 11-38.

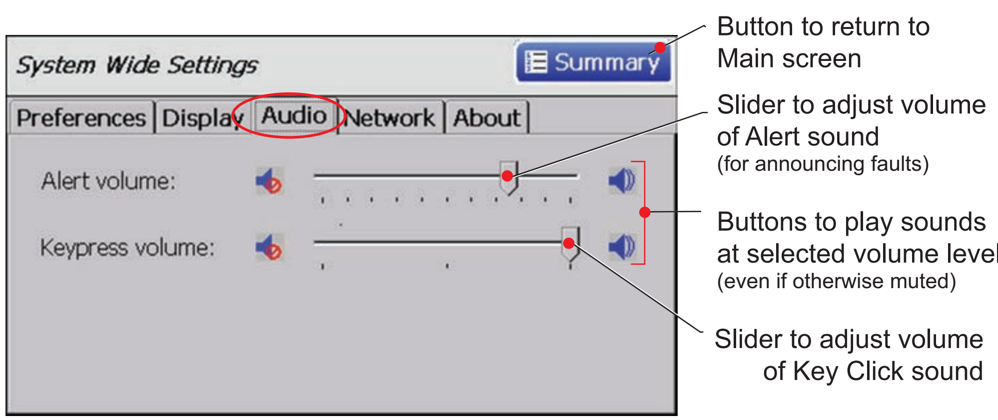


Figure 11-38. OBIS Scientific Remote – Audio Tab

System-Wide Settings: Network Tab

Press the **Settings** button on the Main screen and then click the **Network** tab to access this menu, shown in Figure 11-39.

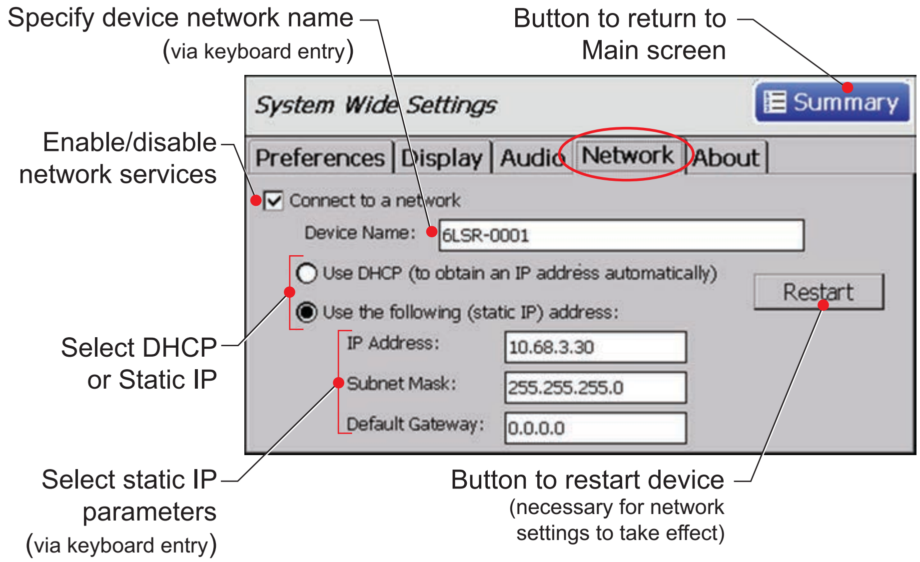


Figure 11-39. OBIS Scientific Remote – System-Wide Settings Network Tab

System-Wide Settings: About Tab

Press the **Settings** button on the Main screen and then click the **About** tab to access the menu shown in Figure 11-40. This screen displays other system information. Click the Summary button to return to the Main screen.

Figure 11-40. OBIS Scientific Remote – System-Wide Settings About Tab

Laser Operating Properties: Navigation Controls

Figure 11-41 shows the navigation controls in the Laser Operating Properties dialog box.

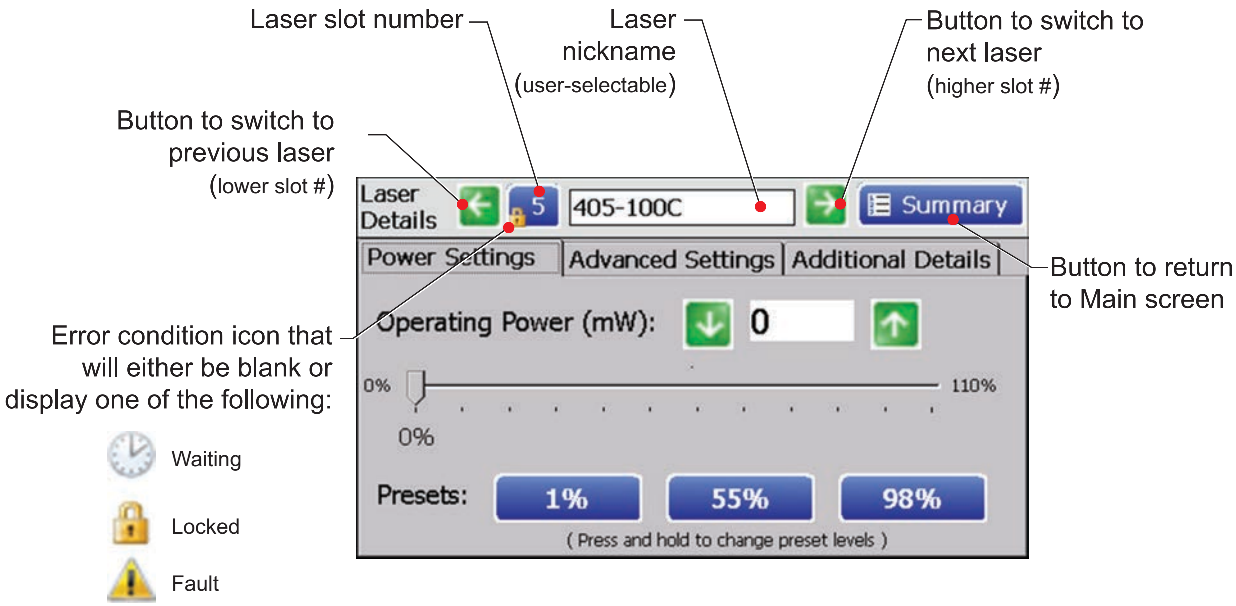


Figure 11-41. OBIS Scientific Remote – Laser Operating Properties, Navigation Controls

Laser Operating Properties: Power Settings Tab

Figure 11-42 shows the Power Settings tab in the Laser Operating Properties dialog box.

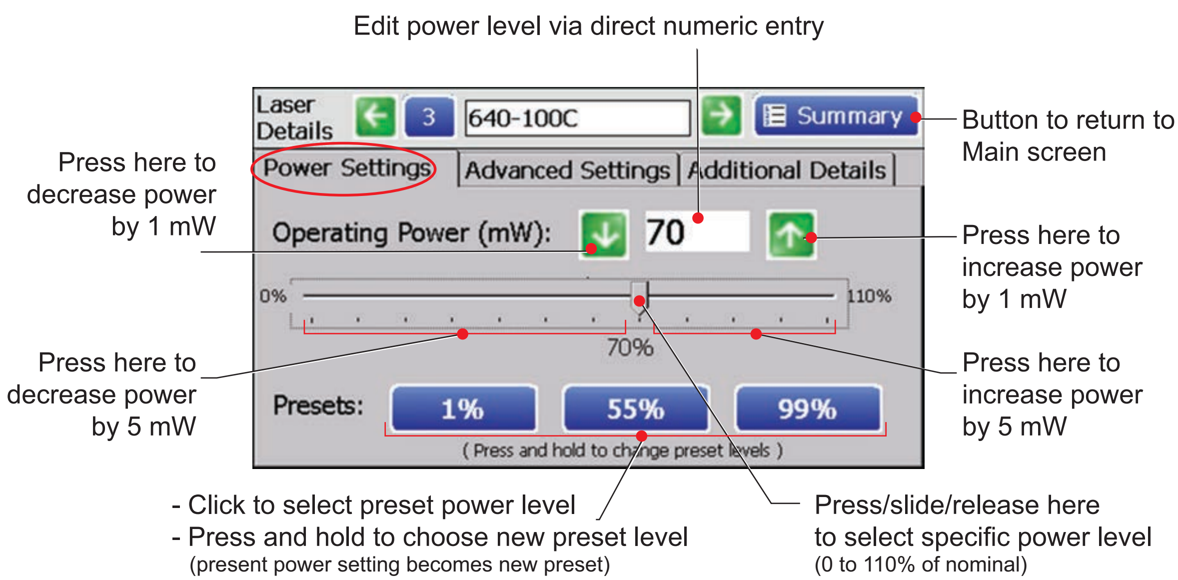


Figure 11-42. OBIS Scientific Remote – Power Settings Tab

Set power levels either via direct entry or using the keypad (shown in Figure 11-43).

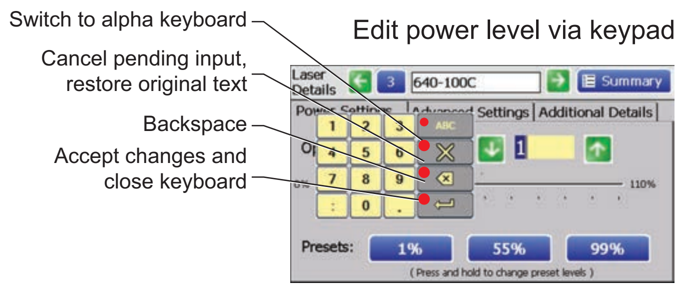


Figure 11-43. OBIS Scientific Remote – Set Power Level via Keypad

Laser Operating Properties: Advanced Settings Tab

Figure 11-44 shows the Advanced Settings tab in the Laser Operating Properties dialog box.

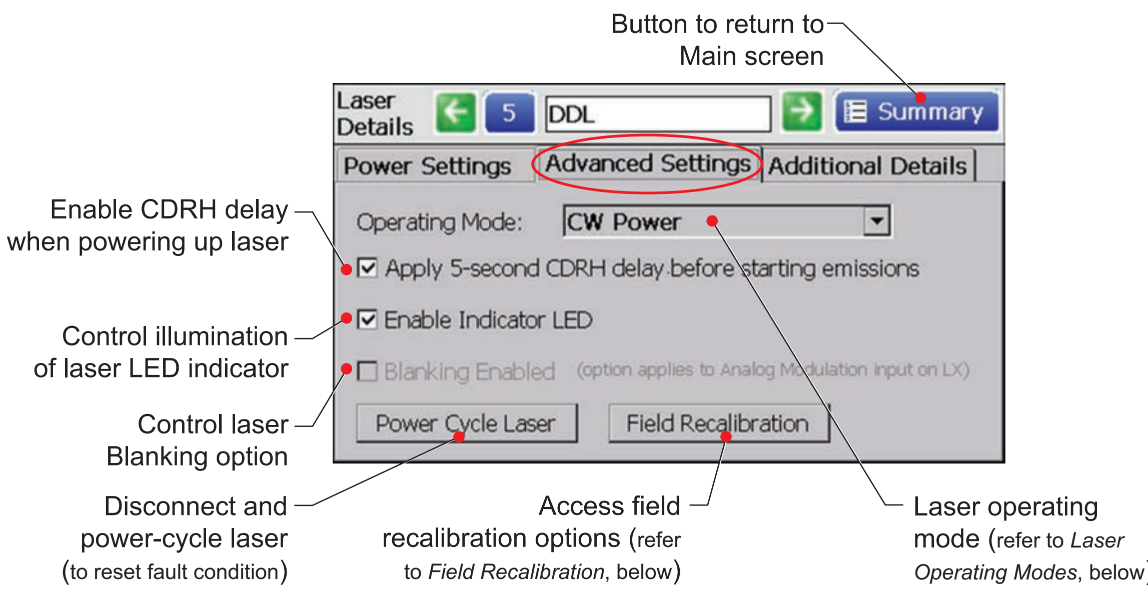


Figure 11-44. OBIS Scientific Remote – Advanced Settings Tab

Field Recalibration

Figure 11-45 shows the options for Field Recalibration. This applies only to OBIS 2.x lasers.

Perform Field Power Recalibration

To perform field recalibration for power, see instructions in Figure 11-46:

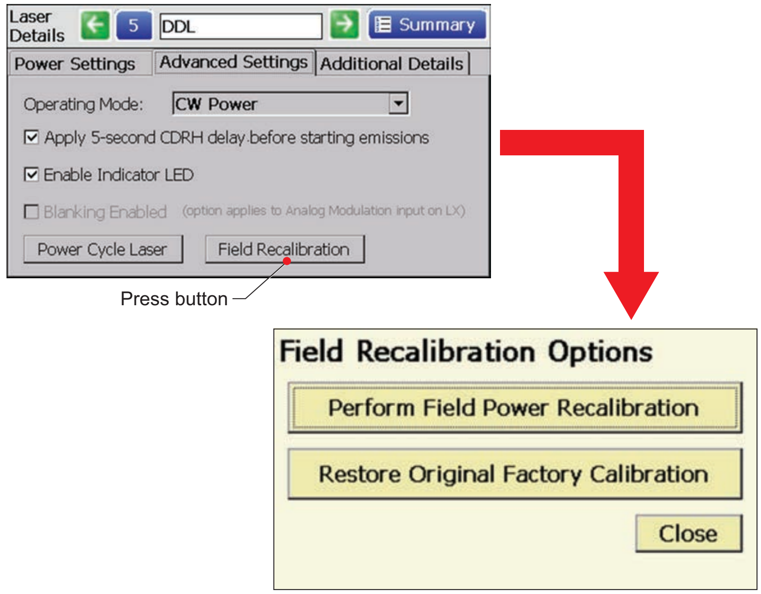


Figure 11-45. OBIS Scientific Remote – Field Recalibration

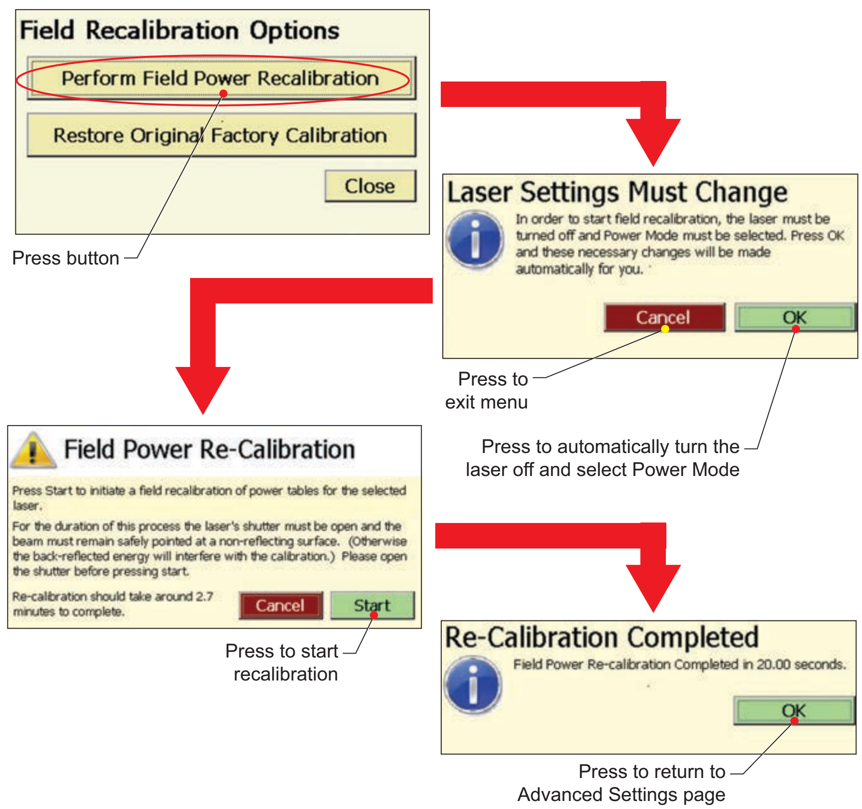


Figure 11-46. OBIS Scientific Remote – Perform Field Power Recalibration

Restore Original Factory Recalibration

To restore the original factory settings using field recalibration, see instructions in Figure 11-47:

Laser Operating Modes

Figure 11-48 shows the various operating modes for the lasers:

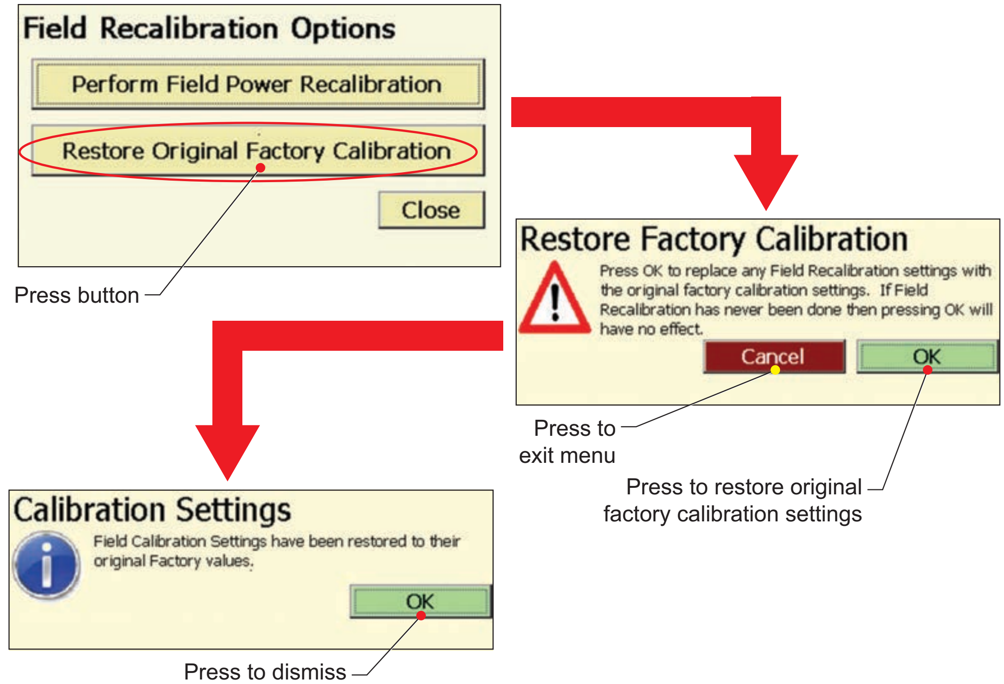


Figure 11-47. OBIS Scientific Remote – Restore Original Factory Recalibration

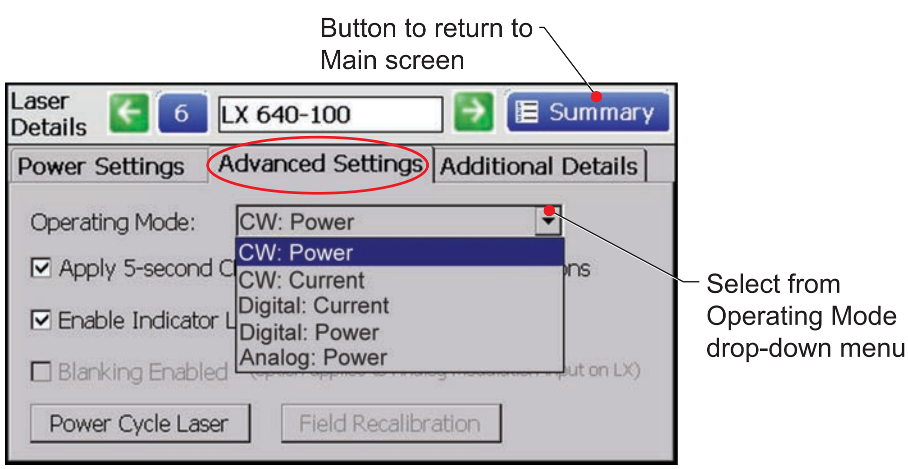


Figure 11-48. OBIS Scientific Remote – Laser Operating Modes

Table 11-7 lists the options for both OBIS LX and OBIS LS lasers:

Table 11-7. Operating Mode Options

OBIS LX LASERS	OBIS LS LASERS
CW: Power	CW Power
CW: Current	Digital Modulation
Digital: Current	Analog Modulation
Digital: Power	Mixed Modulation
Analog: Power	
Mixed: Power	
Mixed: Current	

Laser Operating Properties: CDRH Delay Bypass Warning

Figure 11-49 shows the warning displayed if a person tries to disable the CDRH Delay option:

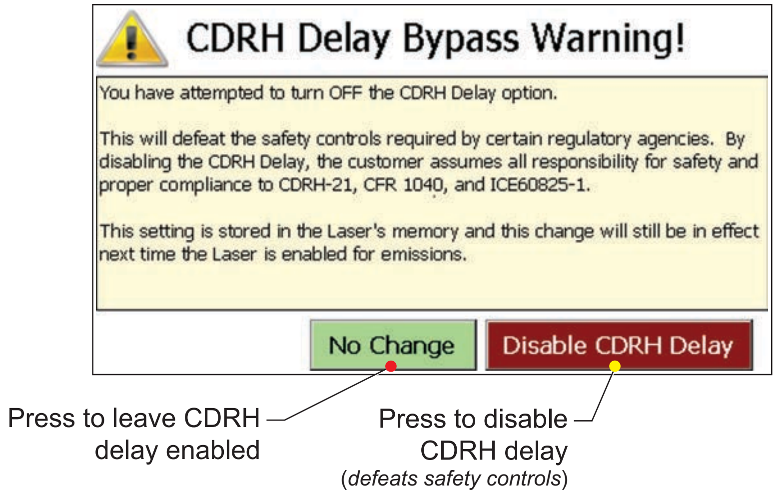


Figure 11-49. OBIS Scientific Remote – CDRH Delay Bypass Warning

Laser Operating Properties: Additional Details Tab

Figure 11-50 shows the dialog box displayed with statistics about the selected laser (details change, according to laser type):

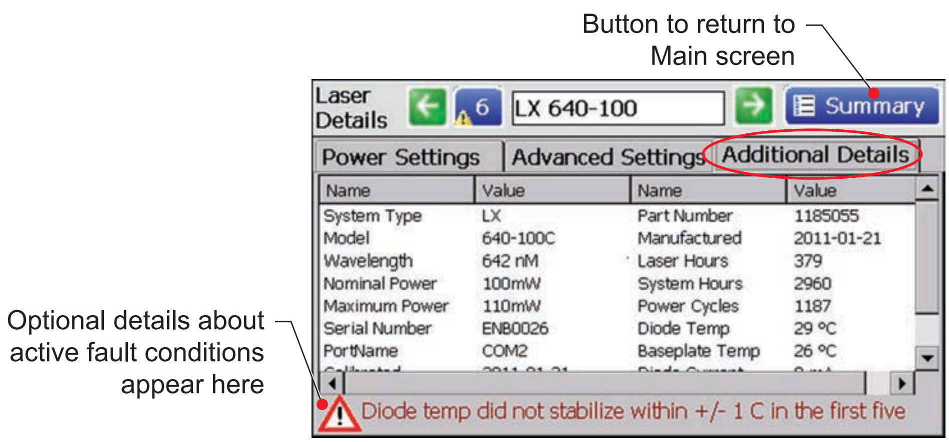


Figure 11-50. OBIS Scientific Remote – Laser Operating Properties, Additional Details Tab

Checksum Error Recovery

Figure 11-51 shows information displayed on-screen when a laser detects a checksum fault:

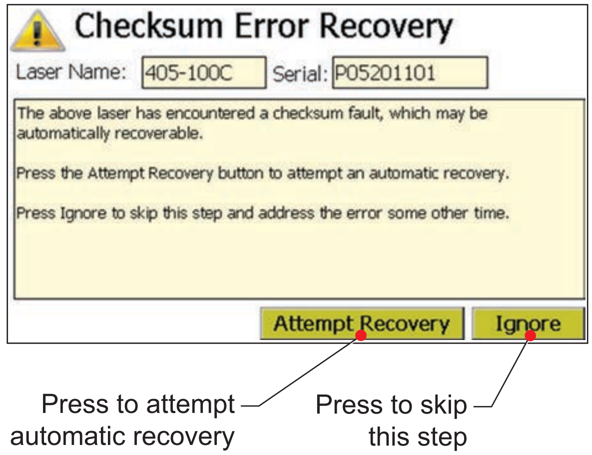


Figure 11-51. OBIS Scientific Remote – Checksum Error Recovery

Figure 11-52 shows information displayed if there were errors during the recovery:

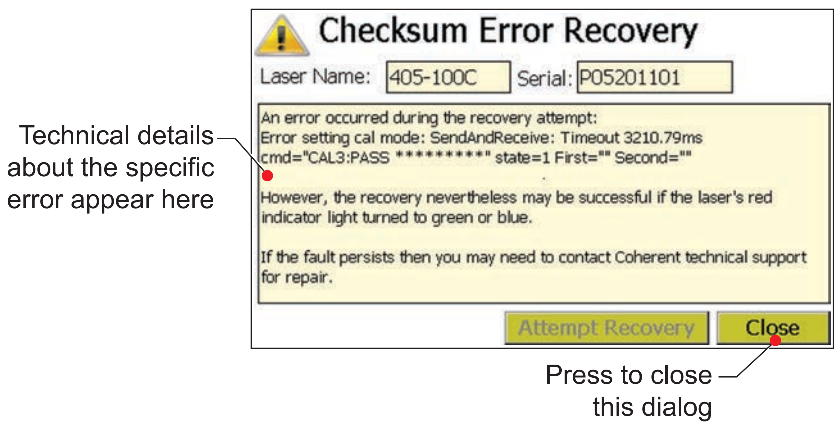


Figure 11-52. OBIS Scientific Remote – Checksum Error Recovery Details

The correct indication of a successful recovery is that the condition disappears.

- Visually confirm that the laser operating LED has changed from red to blue or green.
- The remote should not report the fault condition.
- If the fault continues, contact your Coherent Service representative for assistance.

If the recovery is successful, the screen shown in Figure 11-53 is displayed:

- There were no errors during the recovery and the remote senses that the laser fault was removed.

Any results except those listed above means the recovery was unsuccessful—contact your Coherent Service representative for assistance.

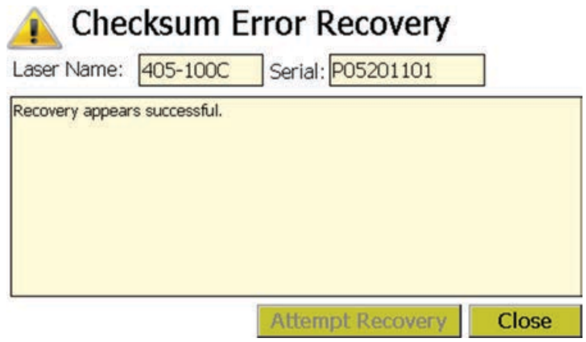


Figure 11-53. Checksum Error Recovery

Device Selection Syntax

For information about how to send host computer commands to each OBIS Laser installed inside of the OBIS Scientific Remote, refer to “Device Selection Syntax” (p. C-6).

Advanced Procedures

Refer to “OBIS Communications through a Terminal Program” (p. 6-5).

Dimensions

Figure 11-54 shows the dimensions for the OBIS Scientific Remote.

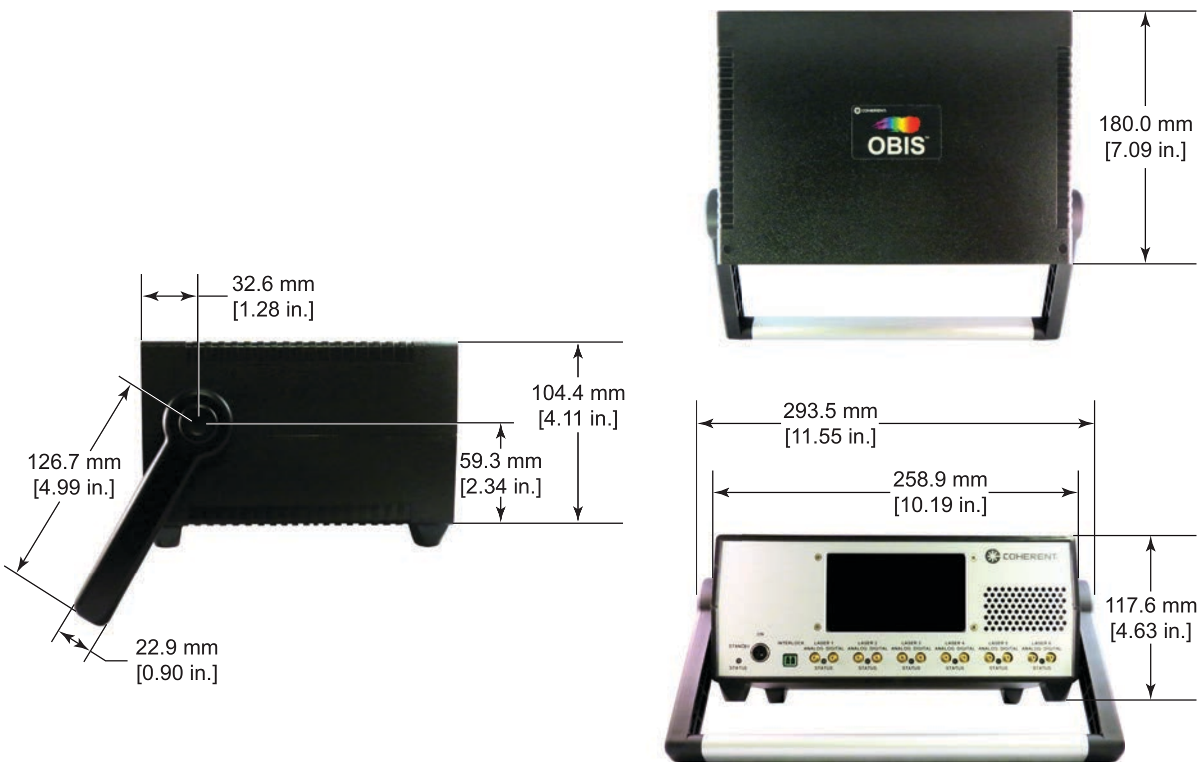


Figure 11-54. OBIS Scientific Remote – Dimensions

For the latest drawing dimensions and product details, see:

https://www.coherent.com/lasers/laser/obis-accessories/obis-scientific-remote

Specifications

Table 11-8 lists the specifications for the OBIS Scientific Remote.

Table 11-8. OBIS Scientific Remote Specifications

PARAMETER	SPECIFICATION
Remote dimensions	183 x 294 x 110 mm
Laser Out connectors	Six @ 12VDC 1.5A
Operating temperature range	0 to 40°C
Operating humidity range (non-condensing)	30 to 85%
Storage temperature range	-20 to 70°C
Storage humidity range (non-condensing)	30 to 95%
Interlock(s)	One keyswitch One dual pin
Power input	90 to 264 VAC, 47 to 63 Hz @ 2.5A max

For the latest specifications, see:

https://www.coherent.com/lasers/laser/obis-accessories/obis-scientific-remote

Repacking Procedure

To repack the OBIS Scientific Remote:

1. Place the six cables and the power cable in the bottom of the shipping box, then place a "trampoline" frame on top of the cables with the film side up, as shown in Figure 11-55.

Figure 11-55. OBIS Scientific Remote – Repacking Step 1

2. Put the OBIS Scientific Remote unit in the pink ESD bag, then place the unit on top of the bottom packaging, as shown in Figure 11-56. Make sure the unit is positioned above the "trampoline" frame.

Figure 11-56. OBIS Scientific Remote – Repacking Step 2

3. Place the second “trampoline” frame on top the Scientific Remote. Put the USB flash drive and the interlock keys in a small zip bag and tape the bag to the top of the “trampoline” frame, as shown in Figure 11-57.

Figure 11-57. OBIS Scientific Remote – Repacking Step 3

4. Close the shipping box and secure the box with tape, as shown in Figure 11-58.
5. *If returning the system to Coherent for service*:
    - Contact Coherent Customer Service (1.800.343.4912) to get a RMA number.
    - Include the RMA number on the shipping label.

Figure 11-58. OBIS Scientific Remote – Repacking Step 4

Troubleshooting Procedures

OBIS Lasers are designed to be operated as assembled. There are no user-serviceable parts inside. DO NOT remove covers!
The Coherent Warranty is VOID if the enclosure is disassembled.

Table 11-9 lists possible problems, with a reference to the related troubleshooting checklist.

Table 11-9. OBIS Scientific Remote Troubleshooting Procedures

PROBLEM	REFERENCE
The Scientific Remote touch screen is dark.	Checklist 1 (this page)
The Scientific Remote does not power on.	Checklist 2 (this page)
The Scientific Remote touch screen is not responsive.	Checklist 3 (p. 11-33)
A laser is not listed on the Scientific Remote touch screen.	Checklist 4 (p. 11-33)
The Scientific Remote or lasers attached to the unit are not being accessed by Coherent Connection on the host PC.	Checklist 5 (p. 11-34)

Instructions for each of these checklists are provided in the following sub-sections.

Checklist 1: The Scientific Remote touch screen is dark.

If the touch screen is dark, do the following steps in the order shown:

[ ] Tap anywhere on the screen to suspend Automatic Display Blanking (in case the blanking option is enabled).

[ ] Power cycle the unit and wait for the Coherent Splash screen to confirm that the touch screen is working properly.

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Checklist 2: The Scientific Remote does not power on.

If the unit does not power on, do the following steps in the order shown:

[ ] Power cycle the Scientific Remote and wait for the Coherent Splash screen to confirm that the unit is powered.

[ ] Check the power cable connection at the unit and the connection at the wall socket.

[ ] Turn on the power switch and listen for fan noise. If there is no fan noise, the power supply fuse may be blown. Replace the fuse, if necessary.

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Checklist 3: The Scientific Remote touch screen is not responsive.

If the touch screen is responding erratically to touches, do the following steps in the order shown:

[ ] Run the touch screen calibration function.

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Checklist 4: A laser is not listed on the Scientific Remote touch screen.

If the touch screen does not list a laser, do the following steps in the order shown:

[ ] Check the SDR cable connections to the laser.

[ ] Disconnect and then reconnect the SDR cable to the laser.

[ ] Power cycle the Scientific Remote.

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Checklist 5: The Scientific Remote or lasers attached to the unit are not being accessed by Coherent Connection on the host PC.

If the Coherent Connection software does not access the unit or does not access the attached lasers, do the following steps in the order shown:

[ ] Check the following connections between the host PC and the Scientific Remote:

- RS-232 connections on both ends.
- USB connections on both ends.
- RJ-45 connections on both ends.

[ ] Test the desired connection by itself; disconnect all other connections to the host PC.

[ ] If using a LAN connection, check the Network Connection settings on the Scientific Remote. Contact your IT department if you have questions about your local network. After changing the settings, restart the Scientific Remote for the changes to take effect.

[ ] Restart the Coherent Connection software on the host PC.

[ ] Contact Coherent Technical Support—refer to "Introduction" (p. 8-1) for contact information.

SECTION TWELVE: OBIS LASER BOX

This section includes the following information:

- Description (p. 12-2)
- Overview of the Laser Box installation procedure (p. 12-8)
- Computer control (p. 12-12)
- Interface cable (p. 12-12)
- Device selection syntax (p. 12-12)
- Advanced procedures (p. 12-13)
- Dimensions (p. 12-15)
- Specifications (p. 12-18)
- Repacking procedure (p. 12-19)
- Troubleshooting procedures (p. 12-22)

Figure 12-1 shows the components and accessories for the OBIS Laser Box:

Figure 12-1. OBIS Laser Box System Components and Accessories

Table 12-1 lists the components and accessories for the OBIS Laser Box. For more information and to see additional accessories, refer to “Appendix B: OBIS Accessories Parts List” (p. B-1) Also see information about the OBIS Laser Box on the Coherent website at:

https://www.coherent.com/lasers/laser/obis-accessories/obis-laser-box

Table 12-1. OBIS Laser Box Components and Accessories

ITEM	DESCRIPTION	PART NUMBER
1	OBIS Laser Box (w/mounting brackets)	1228877
2	USB cable, Type A to Type Mini-B (1.8 meters)	1108906
3	Keys for OBIS Laser Box (2 each)	See P/N 1190348 in Table B-1 on page B-1
4	Interlock, shorted, for OBIS Laser Box	
5	USB memory drive (application software and user documentation)	1213052
6	OBIS LX/LS Operator's Manual (PDF file on USB memory drive)	1184163
7	Power cord, 10A, 125V, NEMA5-15P/IEC-320-C13	1106344
8	Power supply, 110/220V AC, 12V DC, IEC-320	1211389

Description

The OBIS Laser Box for OBIS LX/LS offers all the features from the laser in a convenient CDRH-compliant interface with convection cooling.

As with all OBIS LX/LS lasers, the laser itself offers a stand-alone all-in-one laser solution. The OBIS Laser comes with a Power Connection, USB Connection, Fan Connection and a SDR-type Connection for laser control I/O. All of these are on the back panel of every OBIS LX/LS laser.

To simplify integration, the OBIS Laser Box connects to the single SDR-type connector for power, I/O signals, and communication. The OBIS Laser Box then brings all of these features to front panel controls and connectors.

OBIS Laser Box offers conduction cooling for the laser baseplate and cooling fans to maintain the convection cooling for stability across a wide temperature range.

OBIS Laser Box comes with a separate 12 VDC power supply that has enough capacity to drive up to five lasers, interface and cooling.

Front Panel

Features on the OBIS Laser Box front panel are shown in Figure 12-2 and described in the sections that follow.

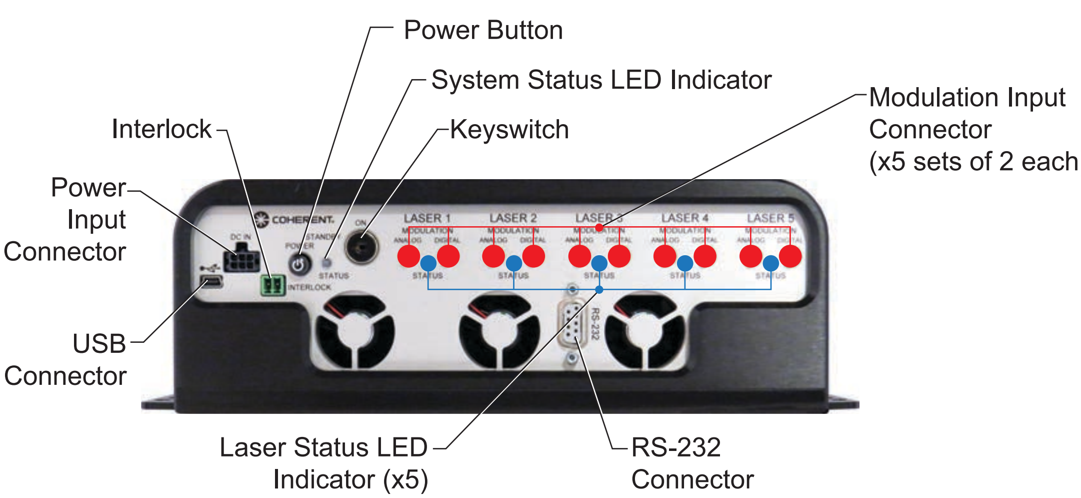


Figure 12-2. OBIS Laser Box Front Panel

Keyswitch

The OBIS Laser Box has a keyswitch, shown in Figure 12-3, that prevents laser radiation in the STANDBY position. Laser radiation can occur while the key is in the ON position. The key is removable in the STANDBY position but not in the ON position.

Figure 12-3. OBIS Laser Box Keyswitch

The keyswitch is the CDRH Manual Reset feature. Following an interlock fault or power interruption, the laser does not auto restart unless the keyswitch is first reset to STANDBY and then back to ON.

Figure 12-4 shows the keyswitch in the STANDBY and ON positions.

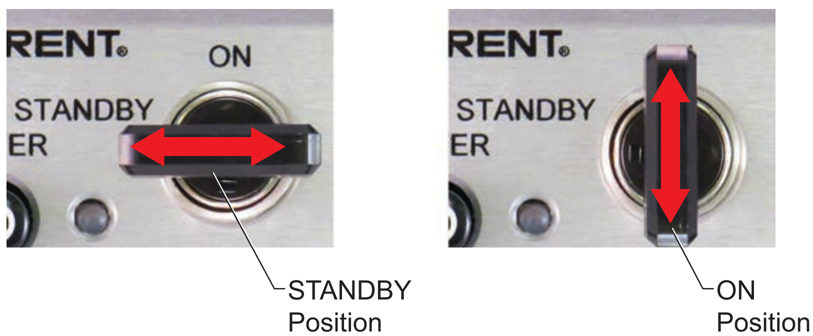


Figure 12-4. OBIS Laser Box Keyswitch STANDBY and ON Positions

Power Button

The push-style power button shown in Figure 12-5 switches power between OFF and ON to the OBIS Laser Box.

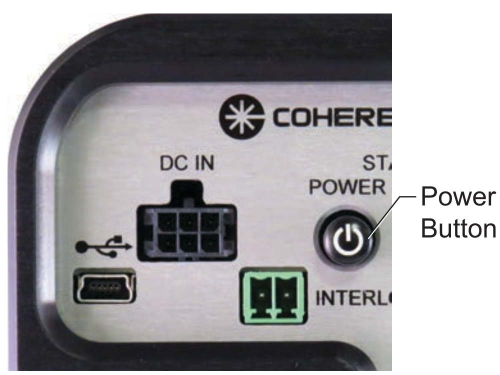


Figure 12-5. OBIS Laser Box Power Button

Power Input Connector

Power is supplied to the OBIS Laser Box through a 6-pin Molex connector, shown in Figure 12-6. The power supply has an ON/OFF switch to power the device. A green LED illuminates when the power is ON. There is no illumination when the power supply is OFF.

For information about the ON/OFF switch on the power supply, refer to “Power Supply” (p. 12-8)

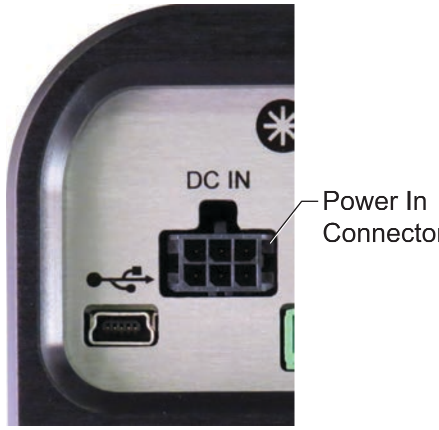


Figure 12-6. OBIS Laser Box Power In Connector

USB Connector

This Mini-B connector lets you connect a host computer to the OBIS Laser Box for communications, shown in Figure 12-7.

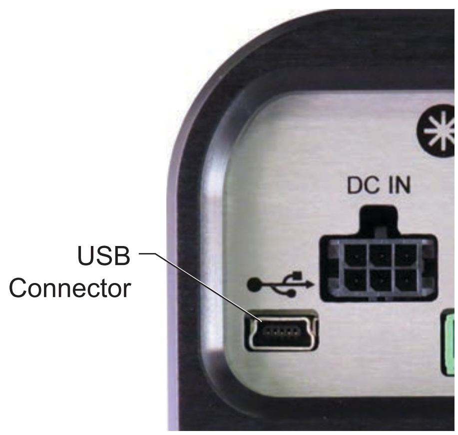


Figure 12-7. OBIS Laser Box USB Connector

The host computer and each OBIS LX/LS laser installed is recognized as a COM device. Communications pass through the SDR connector to the laser.

Coherent Connection software is provided on the USB memory drive and, after installed, communicates with the OBIS Laser Box and each OBIS LX/LS laser.

Host commands and queries can be sent to the OBIS Laser Box and each OBIS LX/LS laser using Coherent Connection or a terminal program, such as HTerm or HyperTerminal. For additional information refer to “Appendix C: Host Interface” (p. C-1).

RS-232 Connector

Attach an RS-232 cable between the DB9F RS-232 connector shown in Figure 12-8 and the RS-232 connector on a personal computer. This connection sends commands through the SDR connector.

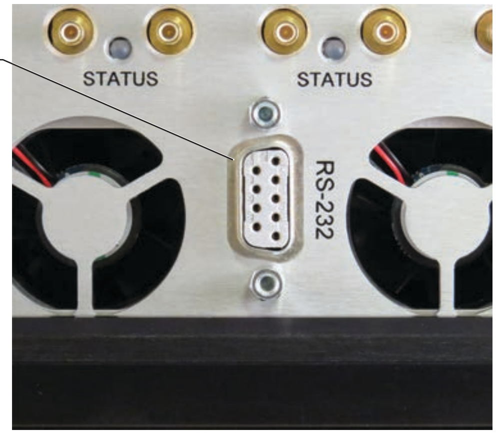


Figure 12-8. OBIS Laser Box RS-232 Connector

Table 12-2 lists the Communication Settings for the RS-232 connector.

Table 12-2. OBIS Laser Box RS-232 Communication Settings

SETTING	VALUE
Baud	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Table 12-3 lists the Pin settings for the RS-232 connector.

Table 12-3. OBIS Laser Box 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)		

System Status LED Indicator

The System Status LED indicator on the front panel (shown in Figure 12-9) displays yellow, green, blue, or red. The state of the OBIS Laser Box determines the color.

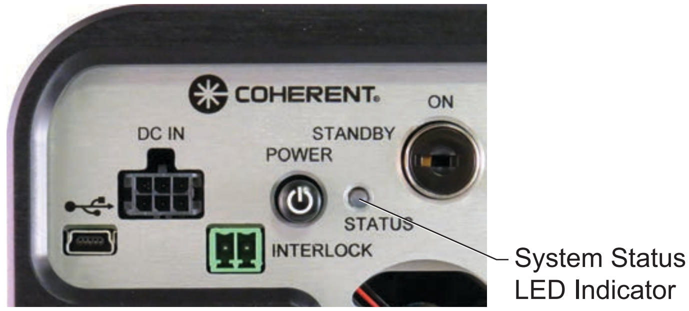


Figure 12-9. OBIS Laser Box System Status LED Indicator

Table 12-4 lists states for the LED indicator on the OBIS Laser Box.

Table 12-4. OBIS Laser Box Status LED States

MODE	LED STATUS	AUTO START	KEYSWITCH POSITION	INTERLOCK STATUS
1	**Blue**	Disabled	STANDBY	X
2	**Blinking Blue**	Disabled	ON at power-up	X
3	**Green**	Disabled	Cycle STANDBY to ON	Closed
4	**Blue**	Enabled	STANDBY	X
5	**Green**	Enabled	ON	Closed
6	**Red**	X	ON	Open

The conditions described are displayed at power ON.

- **Mode 1**: A blue LED with Auto Start disabled and the keyswitch in the STANDBY position. The interlock can be either in or out at this time, as the OBIS Laser Box is not looking for the interlock plug.
- **Mode 2**: A blinking blue LED that displays when you have the keyswitch in the ON position when you power-up the OBIS Laser Box. You must cycle the keyswitch to STANDBY, then ON, to clear this condition.
- **Mode 3**: A green LED appears when you have correctly powered up the OBIS Laser Box, cycled to the ON position, disabled Auto Start, and inserted the interlock plug.
- **Mode 4**: The first configuration that includes Auto Start. When you power-up the OBIS Laser Box and the keyswitch is on STANDBY, the LED will be blue.
- **Mode 5**: The correct sequence for the OBIS Laser Box if Auto Start is enabled. The LED is green when you power the OBIS Laser Box with the keyswitch ON and Auto Start is enabled.
- **Mode 6**: This red LED indicates that the interlock was opened with the keyswitch in the ON position.

WARNING!
When the keyswitch is ON, the interlock plug is connected, and the laser power switches are ON and illuminated, there can be laser emission.

Laser Status LED Indicator

Each of the five Status LED indicators displays the status of one laser that is connected to a specified Modulation In connector.

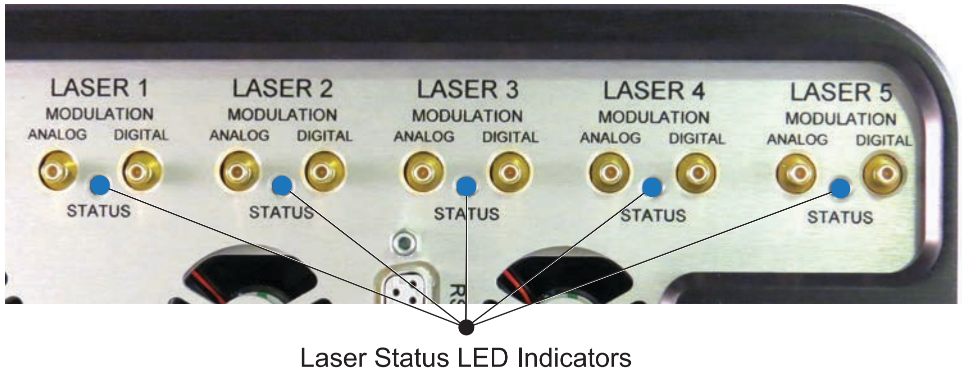


Figure 12-10. OBIS Laser Box Laser Status LED Indicators

Table 12-5 lists the states for the LED Status indicator.

Table 12-5. OBIS Laser Box Individual Laser Status LED States

LED COLOR	STATE
Blue	STANDBY
Blinking Green	WARM UP
White	EMITTING
Red	FAULT

Interlock

The interlock has terminal-style connections that allow connecting to an external control device. A mechanical-style jumper for CDRH interlock is included.

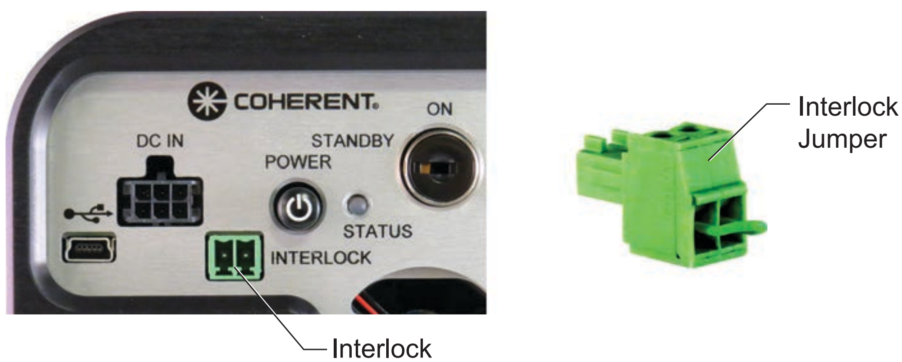


Figure 12-11. OBIS Laser Box Interlock

Modulation Input Connector

There are five sets of SMB connectors (one Digital connector and one Analog connector in each set). These sets connect to buffer amplifiers within the OBIS Laser Box and are converted to differential signals to the lasers. The input impedance of the digital input is 50 ohms and the analog input impedance is 2000 ohms.

For more information about analog modulation, refer to “Analog Modulation (OBIS Remote)” (p. 4-7).

Back Panel

The back panel of the OBIS Laser Box has two air intakes, shown in Figure 12-12. These air intakes include removable air filters for easy cleaning.

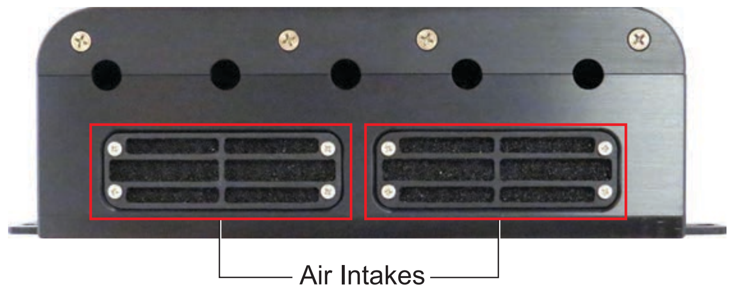


Figure 12-12. OBIS Laser Box Back Panel

Power Supply

Figure 12-13 shows the Power Supply for the OBIS Laser Box.

Figure 12-13. OBIS Laser Box Power Supply

Overview of the Laser Box Installation Procedure

The procedure given in this section describes how to install an OBIS LX/LS fiber-pigtailed laser into the Laser Box.

NOTICE!
Operating the laser without the Laser Box is non-CDRH compliant.

The installation procedure has the following steps:

1. Remove the fiber and the laser from the shipping tray.
2. Remove the lid from the Laser Box.
3. Remove the strain relief back plate.
4. Connect the OBIS LX/LS FP Laser into an available laser bay by connecting the mating SDR connectors.

Hint: Installing multiple OBIS LX/LS lasers in ascending or descending order of wavelength may help you identify which OBIS laser is installed in a particular bay after the lid is re-installed.

5. Attach the OBIS Laser to the heatsink by using the four M3 x 35 mm screws and washers provided with the laser.
6. Reinstall the strain relief back plate.
7. Reinstall the Laser Box lid.

Procedure

To unpack and install the laser:

1. Loosen the removable zip ties to release the fiber and then remove the four screws that anchor the laser to the tray, as shown in Figure 12-14.

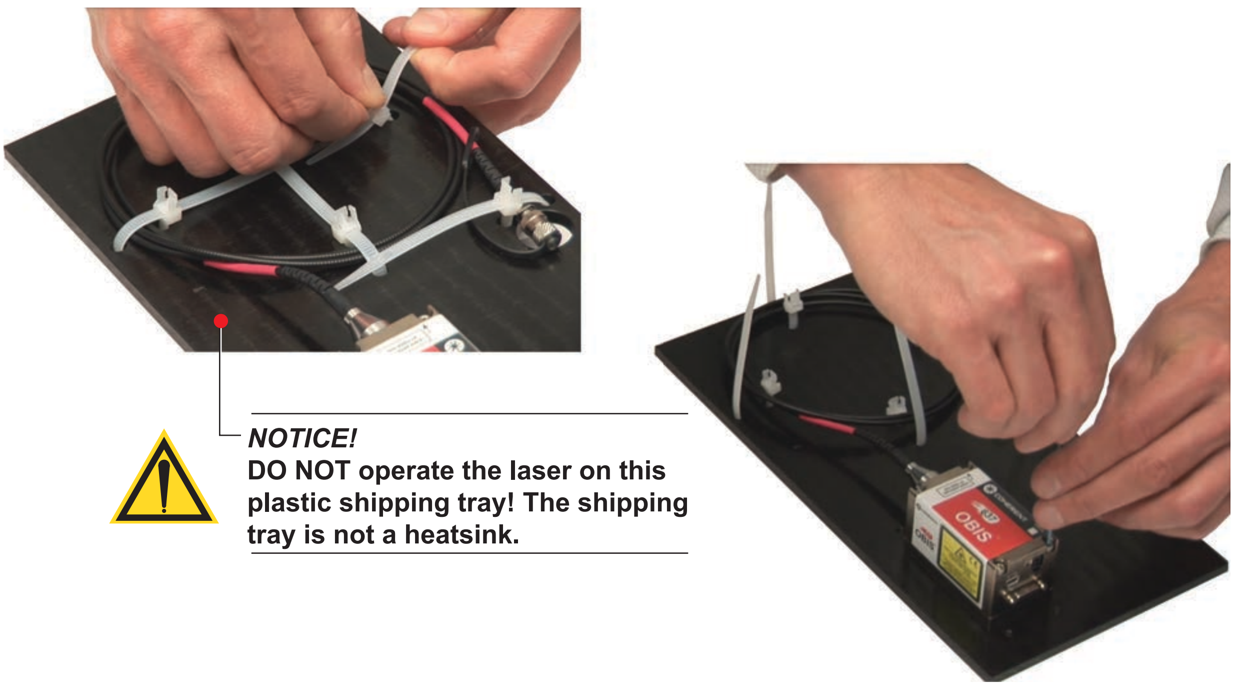


Figure 12-14. OBIS Laser Box Removing the Fiber and the Laser from the Shipping Tray

2. Remove the eight lid screws shown in Figure 12-15 and take off the lid.

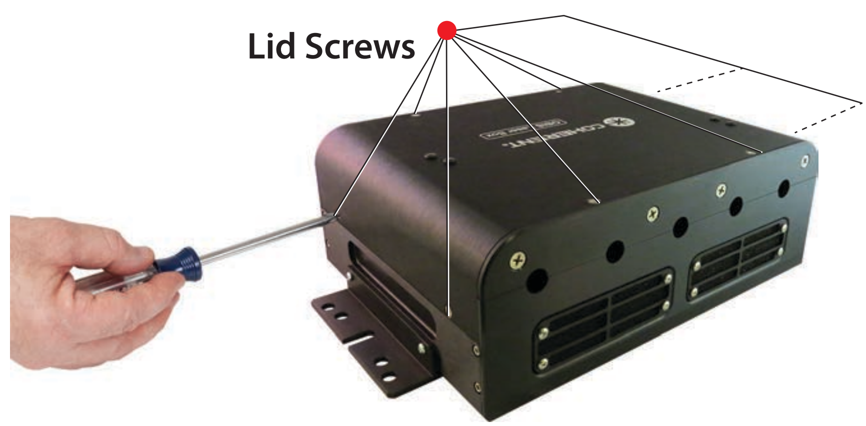


Figure 12-15. OBIS Laser Box Removing the Laser Box Lid

3. Remove the four back plate screws and set aside the plate, as shown in Figure 12-16.

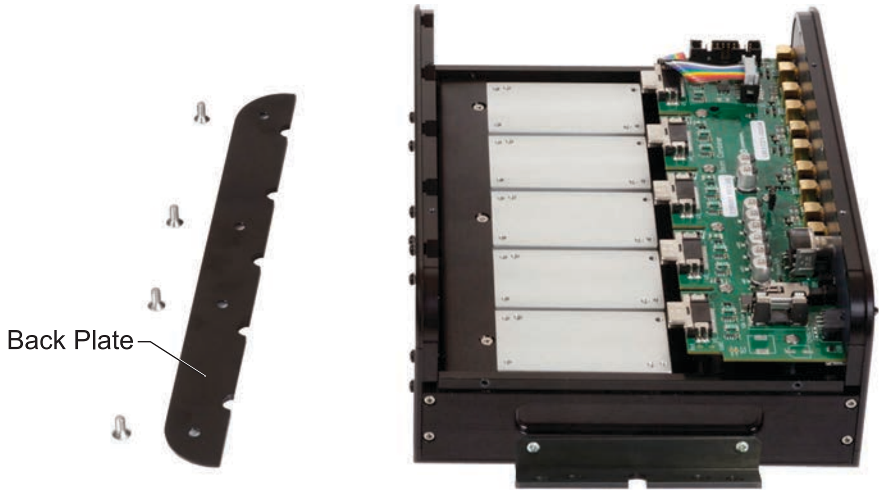


Figure 12-16. OBIS Laser Box Removing the Back Plate

4. Insert the OBIS Laser by connecting the mating SDR connectors, as shown in Figure 12-17.

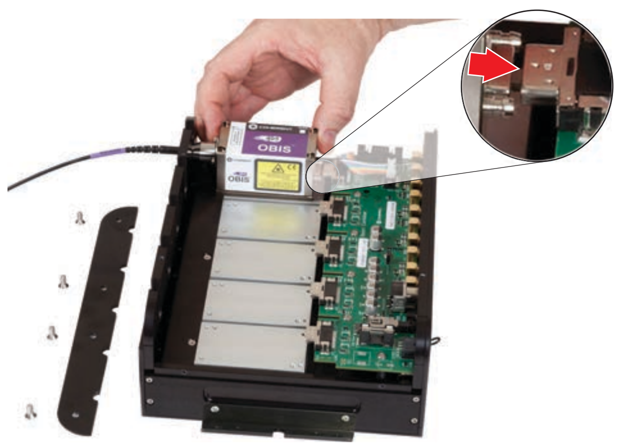


Figure 12-17. OBIS Laser Box OBIS LX/LS Laser Installation

5. Align the laser to the heatsink.

6. Locate the M3x35 mm screw kit supplied with the OBIS Laser (shown in Figure 12-18).

7. Use the screw kit to secure the laser to the heatsink, as shown in Figure 12-19. Use the washers to spread the tightening force.

Figure 12-18. Screw Kit

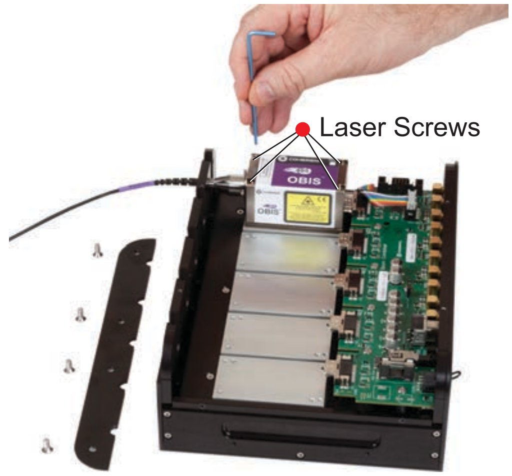


Figure 12-19. OBIS Laser Box Attaching the Laser to the Heatsink

8. Tighten the screws in a diagonal pattern shown in Figure 12-20 for best results in 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.).

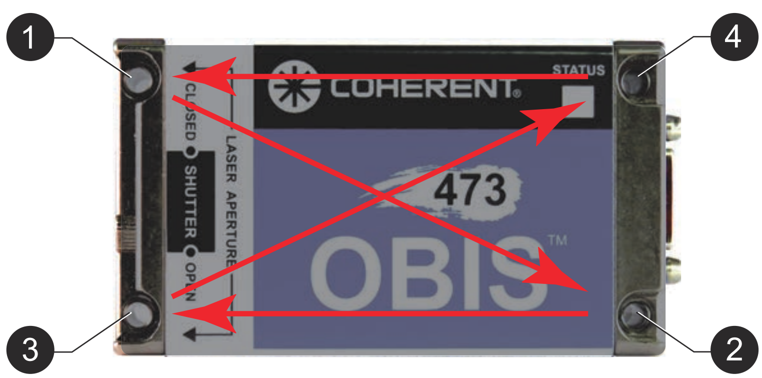


Figure 12-20. Tightening Pattern for Mounting the OBIS Laser

9. Reinstall the back plate using the four screws previously removed, as shown in Figure 12-21.

10. Reinstall the lid as shown in Figure 12-22, using the eight screws previously removed.

Figure 12-21. OBIS Laser Box Reinstalling the Back Plate

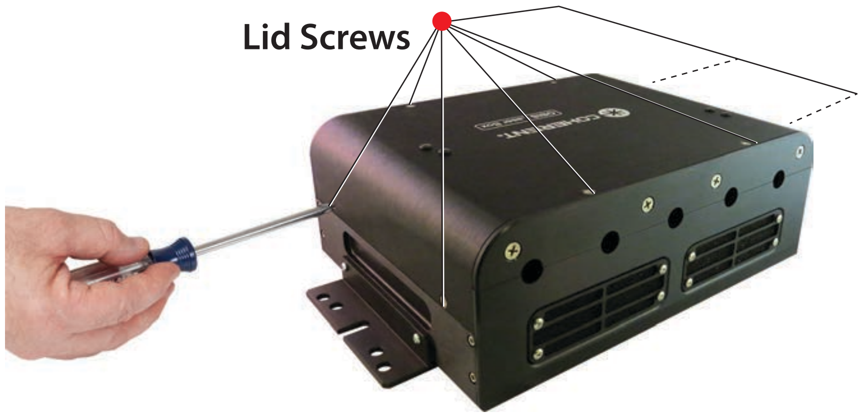


Figure 12-22. OBIS Laser Box Reinstalling the Laser Box Lid

Computer Control

Refer to “Section Five: Coherent Connection” (p. 5-1). Refer to “Appendix C: Host Interface” (p. C-1) for a detailed description of the available commands and queries.

Interface Cable

The OBIS Laser System includes a Coherent 1-meter SDR-style cable connection between the laser and the OBIS Laser Box. ***Use only a Coherent OBIS Laser-to-Remote SDR cable—DO NOT use a Camera Link cable.***

Device Selection Syntax

For information on how to send host computer commands to each OBIS Laser installed inside of the OBIS Laser Box, refer to “Device Selection Syntax” (p. C-6).

Advanced Procedures

Refer to “Section Six: Advanced Procedures for the OBIS Laser System” (p. 6-1).

CDRH Delay

The OBIS Laser System ships as a CDRH-compliant configuration. The CDRH-required delay of five seconds or more occurs between a laser-ready condition and emission of laser light.

- For an OBIS LX the CDRH delay is five seconds.
- For an OBIS LS the CDRH delay is 10 seconds.

This delay lets the user take appropriate safety precautions before laser emission. When the laser is turned OFF (or to STANDBY), the delay is applied to the next time the laser is turned ON. The CDRH setting is stored in laser memory.

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

WARNING!
The following steps to remove 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.

Enable or disable the CDRH Delay using the Advanced tab of the Coherent Connection software, shown in Figure 12-23.

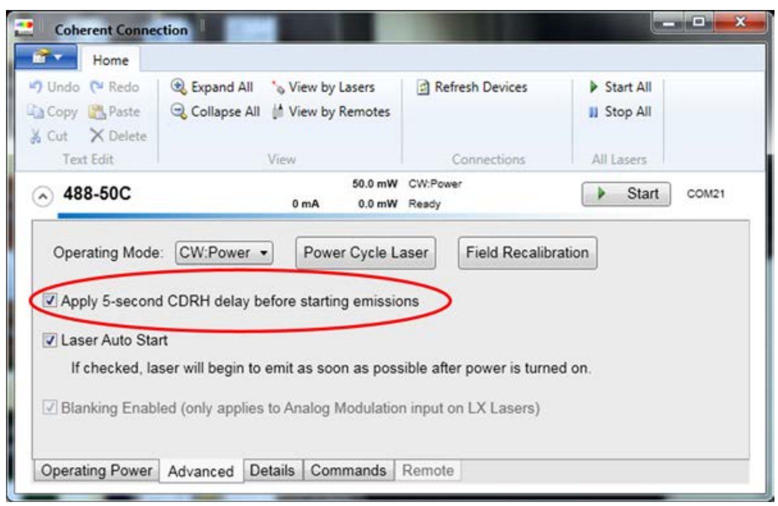


Figure 12-23. Enable/Disable CDRH Delay

Without Coherent Connection, this procedure requires the user to remotely control the OBIS system. To control this setting from a host computer, send the following commands:

1. Use the "SYSTem:CDRH OFF" command to override the CDRH-required delay.
2. Interrogate the current CDRH-required delay status by sending with the "SYSTem:CDRH?" command.
3. Restore the CDRH-required delay feature by using the "SYSTem:CDRH ON" command.

See "Appendix C: Host Interface" (p. C-1) for a list of commands to communicate with the laser.

Enabling Auto Start with the OBIS Laser Box

The OBIS Laser Box is configured with the laser Auto Start feature disabled. In this configuration, the OBIS Laser System is a CDRH-compliant laser system consisting of a Keyswitch, Interlock, and a Power button/switch.

WARNING!
With Auto Start enabled on the OBIS Laser Box, the laser *immediately* begins emission at the next power cycle (with the keyswitch ON), even if the laser was previously turned OFF (0) through a USB or RS-232 command.

- The Shunt Jumper is installed on only one pin of the jumper header, J7. (This is the factory default.)
- To enable Auto Start, install the shunt jumper on both headers pins of J7.

For information about units shipped before April 2017, see Field Service Bulletin (FSB) #822:*OBIS LaserBox Auto Start — Disable and Enable Shunt Jumper.*

Fuse Replacement

NOTICE!
Removing the OBIS Laser Box cover to replace the fuse does *not* void the unit warranty.

If the fuse needs replacement, use a 10 amp, 250 V, 5 x 20 mm, glass tube cartridge (catalog number 218 010P).

1. To access the fuse, remove the eight lid screws and take off the lid, as shown in Figure 12-24.

Figure 12-24. OBIS Laser Box – Access the Fuse

2. Remove the old fuse and install the new fuse, as shown in Figure 12-25.

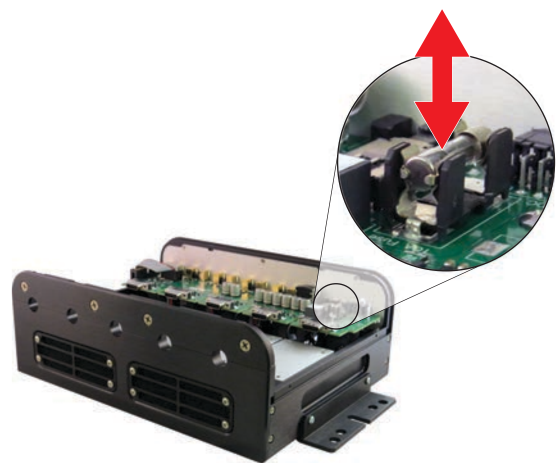


Figure 12-25. OBIS Laser Box Fuse Location

3. Reinstall the lid using the eight screws previously removed.

Dimensions

Figure 12-26 shows the dimensions for the OBIS 6-Laser Remote Power Supply.

For current power supply drawing dimensions and product details, go to the Coherent website at:

https://www.coherent.com/lasers/laser/obis-accessories/obis-power-supply

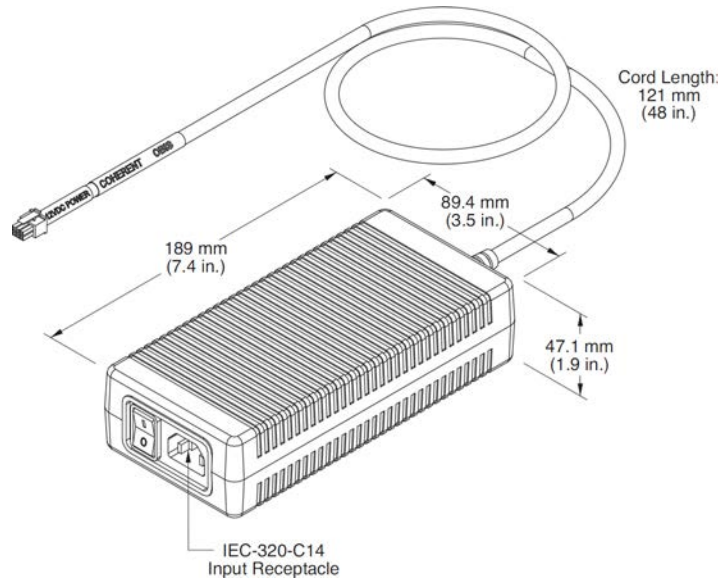


Figure 12-26. OBIS 6-Laser Remote Power Supply Dimensions

Figure 12-27 provides dimensions for the OBIS Laser Box.

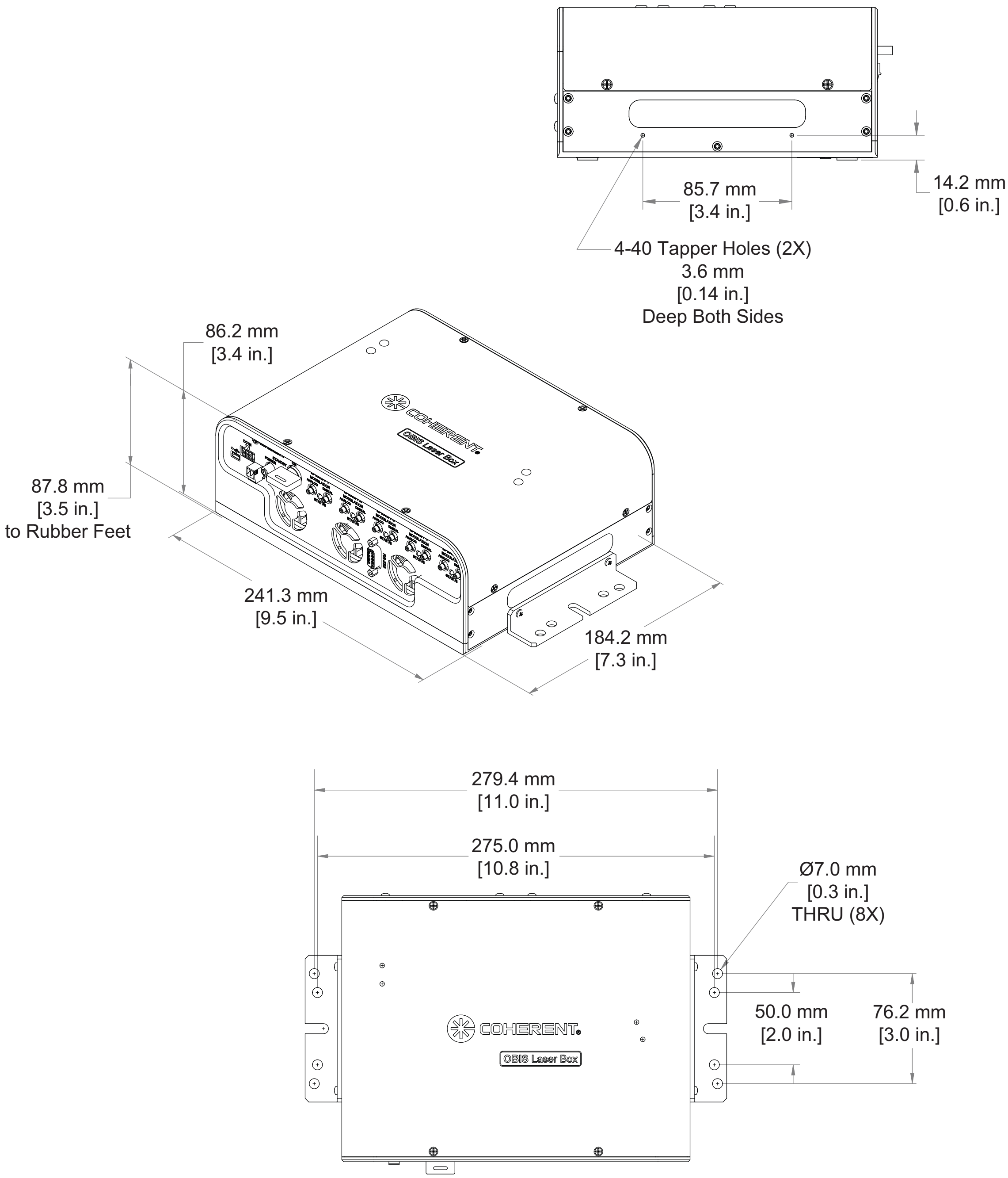


Figure 12-27. OBIS Laser Box Dimensions

Specifications

Table 12-6 lists specifications for the OBIS Laser Box:

Table 12-6. OBIS Laser Box Specifications

PARAMETER	SPECIFICATION
System Specifications	
OBIS Laser Box Laser box—5 bay[a] Power supply[b]	 P/N 1228877 Included
Host Computer remote control via USB[c]	USB 2.0, Mini-B
Host Computer remote control via RS-23[c]	RS-232, 115.2K, $8N_1$, DB-9F
Analog inputs, 5 each	SMB connector, 0 to 5V, 2000 Ohm input impedance
Digital inputs[d]	SMB connector, 0 to 3V, 50 Ohm input impedance
Interlock	Yes, included with shorting wire
Laser status indicators	Yes, individual LED for each laser
Warm-up time (minutes) (from cold start)	< 2
Coherent Connection software for PC	Included on USB drive with operator's manual
Safety	Keyswitch and interlock
Utility and Environmental Requirements	
Power consumption (typical) with no lasers	5W
Power consumption (maximum)	140W
Internal cooling fan	Yes, 3 each
Power input to laser box, 6-pin	10 to 14 VDC at 10A maximum Molex 43025-0600 for mating connector
Power cord (USA)	2.4 m (8 ft.)
Operating condition[e]	0 to 40°C
Non-operating condition[e]	-10 to 60°C
Shock tolerance (6 ms)	20 g
Operating voltage	90 to 264 VAC, 47 to 63 Hz
Dimensions (L x W x H)	241 x 184 x 88 mm (9.5 x 7.3 x 3.5 in.)
Weight	3.9 kg (8.5 lb.)

a. Lasers sold separately.
b. Power supply included. Order item number 1211389 for spare or replacement.
c. Host computer not provided. RS-232 and USB cable not provided.
d. Digital modulation can be driven up to 5 Volts.
e. Non-condensing.

For current specifications for the OBIS Laser Box, go to the Coherent website at:

https://cohrcdn.azureedge.net/assets/pdf/OBIS-Laser-Box-Data-Sheet.pdf

Repacking Procedure

Follow these steps to package and ship the OBIS Laser Box:

1. Put the OBIS Laser Box in an anti-static foil bag.

Figure 12-28. Insert Box into Anti-Static Foil Bag

2. Place the anti-static foil bag in the right side of the shipping box.

Figure 12-29. Insert Bagged Laser Box into Shipping Box

3. Place the keys, laser interlock, and USB memory drive into the ESD pink poly accessories bag.

Figure 12-30. Add Components to Poly Bag

4. Place the power supply in the left side of the shipping box. Fold the bottom egg-crate foam upward to create a pad between the power supply and the OBIS Laser Box.

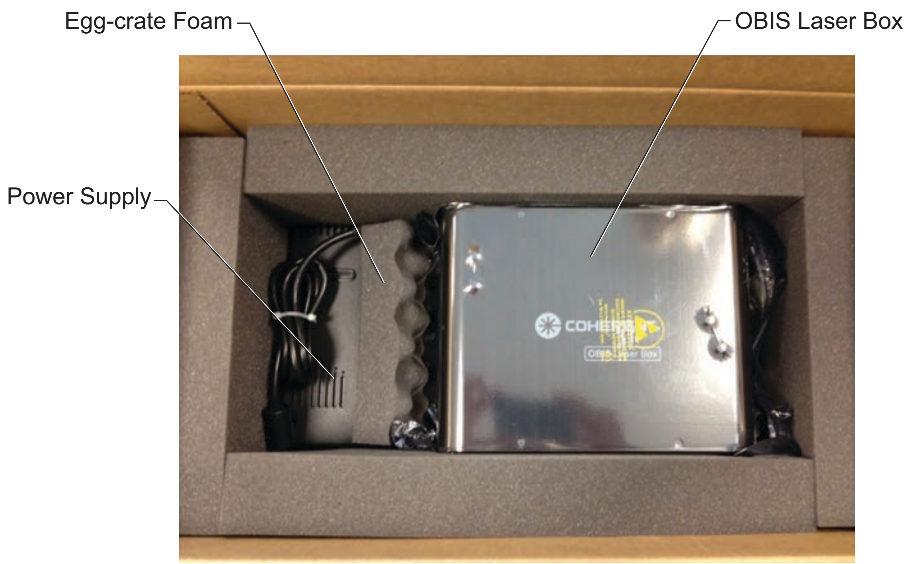


Figure 12-31. Fold Egg-Crate Foam

5. Put the accessories bag, USB cord, and power cord into the left chamber of the shipping box.

Figure 12-32. Place Components in Box

6. Position the smaller foam panel, egg-crate side down.

Figure 12-33. Add Smaller Foam Insert

7. Position the larger foam panel.

Figure 12-34. Add Top Foam in the Box

8. Close the shipping box and secure the box with tape.
9. If you are returning the system to Coherent for service:
   - Contact Coherent Customer Service (1.800.343.4912) to get a RMA number.
   - Include the RMA number on the shipping label.

Figure 12-35. Close Shipping Box

Troubleshooting Procedures

Shown below are possible problems, with a reference to the related troubleshooting checklist.

Table 12-7. OBIS Laser Box Troubleshooting Procedures

PROBLEM	REFERENCE
No output power from the laser	Checklist 1 (this page)

Checklist 1: No output power from the laser

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

[ ] Confirm the power supply connector is securely fastened to the OBIS Laser Box.

[ ] Check that the green LED power indicator is illuminated on the top of the OBIS Laser Box power supply.

[ ] Verify the green, two-pin interlock is firmly seated and is not loose.

[ ] Cycle the power ON/OFF by pushing the Power button to the OFF position and then pushing the button again to the ON position. When the Power button is in the ON position, the SYSTEM STATUS LED Indicator should be illuminated; refer to Table 12-4 on page 12-6.

[ ] Toggle the Keyswitch to the STANDBY position and then back to the ON position. The Keyswitch acts as the CDRH Manual Reset. After an interlock fault or power interruption, the laser will not auto restart until the Keyswitch is first reset to the STANDBY position and then back to the ON position; refer to Table 12-4 on page 12-6.

[ ] Check the operating mode of the laser by using Coherent Connection software or the remote command **`SOUR:AM:SOUR?`** For normal CW mode, the laser should be in the “CW Power” mode (from Coherent Connection) or should reply with “CWP” (when sending a query for the set operating mode of the laser).

[ ] If a modulation operating mode is selected, confirm that the proper input signal is being applied to the correct modulation input SMB connector. If operating in Digital modulation, confirm that the voltage source can drive a 50 Ohm load. Many data acquisition boards/cards do not provide enough current to drive a 50 Ohm impedance load.

[ ] Remove the Laser Box cover and check the fuse. For fuse specifications and details on how to replace the fuse, refer to “Fuse Replacement” (p. 12-14).

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

SECTION THIRTEEN: OBIS GALAXY BEAM COMBINER

In this section:

Figure 13-1 shows the components and accessories for the OBIS Galaxy Beam Combiner.

Figure 13-1. OBIS Galaxy System Components and Accessories

Table 13-1 lists the components and accessories for the OBIS Galaxy System.

For additional accessories, refer to “Appendix B: OBIS Accessories Parts List” (p. B-1). Also see information about the OBIS Scientific Remote on the Coherent website at:

https://www.coherent.com/lasers/laser/cw-solid-state-lasers/obis-lasers/obis-galaxy-laser-combiner

Table 13-1. OBIS Galaxy Components and Accessories

ITEM	DESCRIPTION	PART NUMBER
1	Optional configurations for the OBIS Galaxy Beam Combiner: 405, **445**, 488, 514, 532, **552**, 590, 640 405, **458**, 488, 514, 532, **552**, 590, 640 405, **445**, 488, 514, 532, **561**, 590, 640 405, **458**, 488, 514, 532, **561**, 590, 640	 1253553 1253554 1253555 1253556
2	USB memory drive (application software and user documentation)	1213052
3	OBIS LX/LS Operator's Manual (PDF file on USB memory drive)	1184163
4	Desiccant packet	1233443

Description

OBIS Galaxy is a revolutionary plug-and-play design for laser beam combining. With eight FC fiber inputs, the OBIS Galaxy easily accepts a laser with plug-and-play integration.

- Each input is optimized to accept the fiber with a FC/UFC (ultra-flat contact) connection with patented beam combining of all eight inputs.
- The output of the combined eight lasers is a single-mode polarization-maintaining fiber, two meters in length, with a FC/APC connector for your application.

Built with Coherent's rigorous standards using advanced stress-testing techniques, the OBIS Galaxy is both plug-and-play as well as robust, providing superior performance and reliability.

Install a Laser in the OBIS Galaxy

This section describes how to install a Coherent fiber pigtailed FC/UFC laser in the OBIS Galaxy Beam Combiner. Throughout this procedure the OBIS LX laser is used as an example.

NOTICE!
This procedure must be done in a clean environment (flow bench or clean room) in normal humidity and temperature conditions.

NOTICE!
The OBIS FP/UFC laser has a FC/UFC connector. To prevent permanently destroying the OBIS Galaxy fiber-coupling alignment, DO NOT plug any other type of fiber connector into the OBIS Galaxy.

NOTICE!
If using a Galaxy output fiber to couple a free space non-Galaxy OBIS or non-Galaxy Sapphire laser into the OBIS Galaxy, the center wavelength MUST meet the required input wavelength requirement with a tolerance of ± 1 nm.

NOTICE!
Do not loosen, adjust, or remove the output fiber. This connector is factory aligned and is not intended to be adjusted in any manner. Adjusting the output fiber voids the Coherent warranty and reduces performance of the OBIS Galaxy Beam Combiner.

Tools and Supplies Needed

The following tools and supplies are needed to install a laser in the OBIS Galaxy Beam Combiner:

- 5/64” hex wrench
- 7/64” hex wrench
- Tweezers
- Specialized swabs for optics cleaning (example: CleanTips Swabs TX759B)
- 4 desiccant packets, Coherent P/N 1233443 (Tri-Sorb®, 2 g)
- Clean room gloves (example: TechNiGlove International TechNitrile)
- Optics grade methanol/isopropanol
- Torque wrench (optional—not shown in Figure 13-2)
- Laser power meter. See “Appendix J: Power Measurement Instrumentation” (p. J-1) for recommended products.

Figure 13-2 shows the tools and supplies needed to install a laser in the OBIS Galaxy Beam Combiner.

Figure 13-2. Tools and Supplies for Installation

Installation Procedure

To install a laser into the OBIS Galaxy Beam Combiner:

1. Using the 7/64" hex wrench, remove the six top cover screws and lift off the cover, as shown in Figure 13-3.

Figure 13-3. Remove Cover

NOTICE!
The Galaxy box cover must not be open for more than a few hours in normal humidity and temperature conditions.

The interior of the OBIS Galaxy Beam Combiner is shown in Figure 13-4, with the locations of channels for the various wavelengths of lasers:

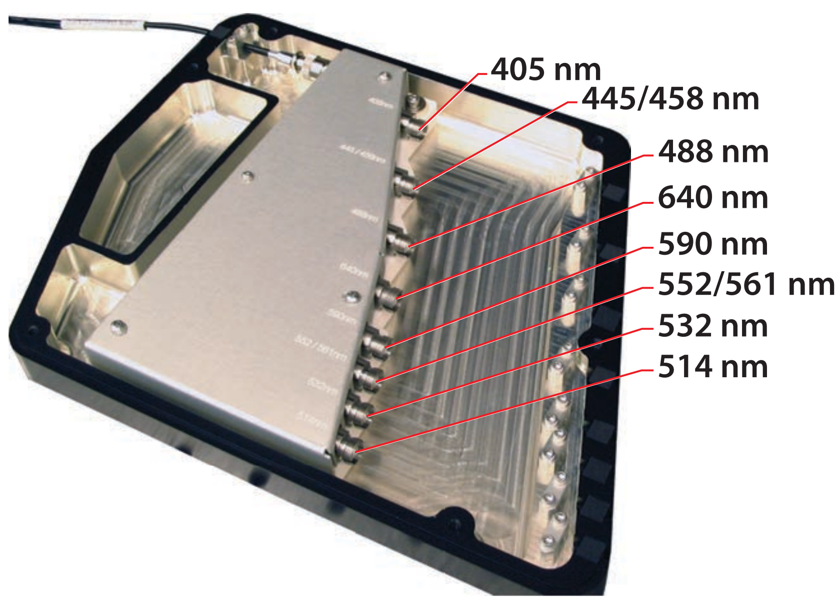


Figure 13-4. OBIS Galaxy Wavelength Channels

NOTICE!
Always plug the laser into the correct wavelength channel in the OBIS Galaxy, shown in Figure 13-4.

2. Discard the desiccant packets, as shown in Figure 13-5.

Figure 13-5. Discard Desiccant Packets

3. Using the 5/64” hex wrench, remove the two strain relief screws (shown in Figure 13-6) for the appropriate wavelength channel and set the strain relief aside. The wavelength channel shown in this procedure uses the OBIS FP/UFC 488 nm laser as an example.

Figure 13-6. Remove Strain Relief Screws

4. Using the tweezers, remove the rubber seal from the fiber channel and set aside.

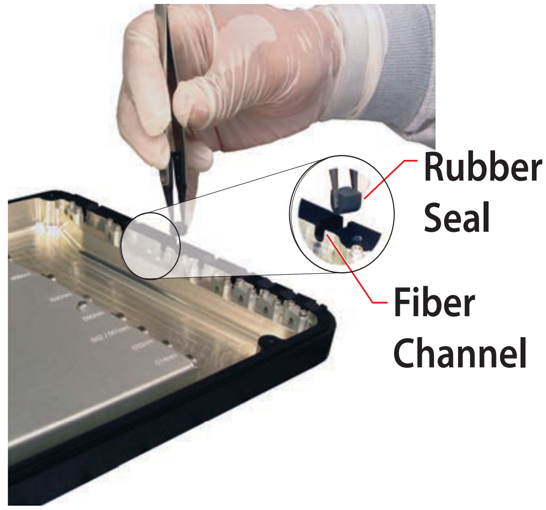


Figure 13-7. Remove Rubber Seal from Fiber Channel

NOTICE!
Store the rubber seal in a clean, air-tight bag. This seal will be needed later if you remove a laser from the OBIS Galaxy.

---

5. Apply 2 to 3 drops of methanol or isopropanol to the tip of a swab, as shown in Figure 13-8. Shake off the excess liquid.

Figure 13-8. Apply Drops to Swab

NOTICE!
Always clean the sleeve and connector completely *before* plugging in the fiber. Coupling visible light into a single-mode fiber is very sensitive to the cleanliness of all parts.

---

6. Insert the swab into the fiber sleeve of the OBIS Galaxy, as shown in Figure 13-9. Rotate the swab one full turn and then remove the swab from the sleeve.

Figure 13-9. Insert Swab into Fiber Sleeve

7. Dry the sleeve by either using a clean air gun (preferred method) or air drying for 30 seconds.
8. Repeat steps 5 through 7 a second time.
9. Apply 1 or 2 drops of methanol or isopropanol to the tip of a swab. Shake off the excess liquid.
10. As shown in Figure 13-10, carefully clean the tip of the ferrule by running the swab over the tip in a continuous motion and in one direction only, *one time*.

Figure 13-10. Clean Tip of Ferrule

11. Dry the tip by either using either a clean air gun (preferred method) or air drying for 30 seconds.
12. Repeat steps 9 through 11 a second time.
13. *Carefully* slide the ferrule into the sleeve while aligning the FC connector key with the sleeve keyway.

NOTICE!
Improper alignment and installation of the FC connector key results in low power from the output fiber.

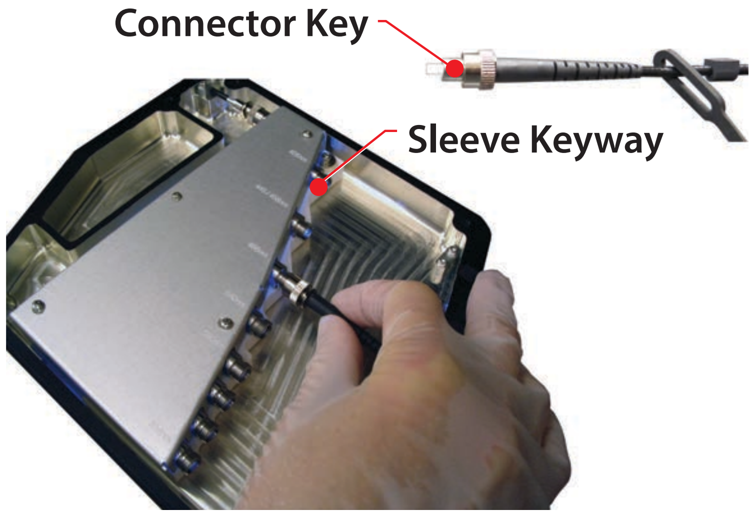


Figure 13-11. Slide the Ferrule Into the Connector key

Monitor Power of the Output Fiber

NOTICE!
During the next step of the installation process, you must monitor the power of the output fiber.

1. First, connect a power meter and sensor to monitor power of the output fiber, as shown in Figure 13-12. See "Appendix J: Power Measurement Instrumentation" (p. J-1) for recommended Coherent equipment.

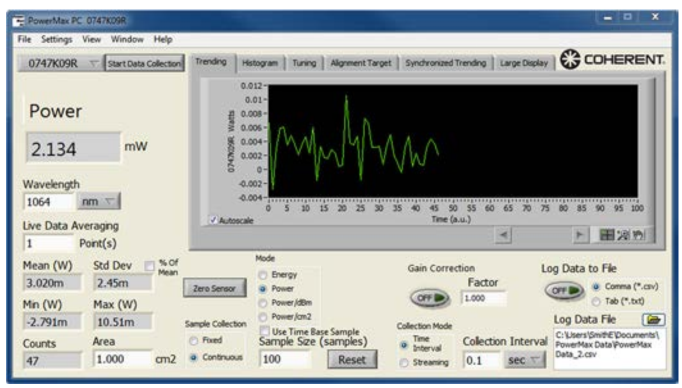


Figure 13-12. Monitor Power of the Output Fiber

2. Maximize the throughput of the new OBIS Laser by biasing the FC connector key (putting a slight rotational pressure on the back part of the connector) clockwise or counter-clockwise in the keyway while tightening the collar.
3. Push the rubber seal back into the fiber channel in the OBIS Galaxy, as shown in Figure 13-13.

Figure 13-13. Reinstall Rubber Seal

4. Using the 5/64” hex wrench, secure the strain relief using the two screws that were previously removed, as shown in Figure 13-14. Torque the screws to 1 in-lb.

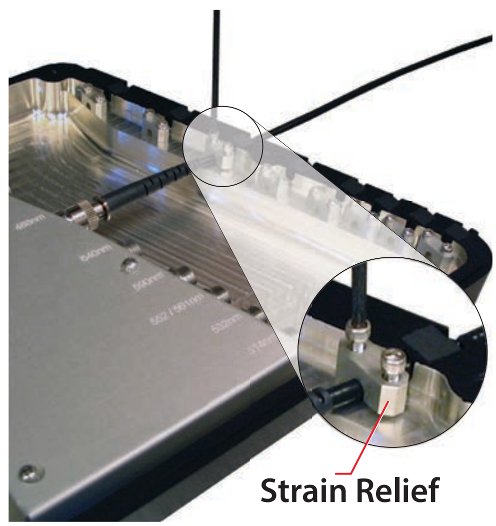


Figure 13-14. Secure the Strain Relief Screws

5. Add four new desiccant packets, as shown in Figure 13-15.

   It is recommended that you change the desiccant packets when:

   - The OBIS Galaxy cover has been removed for longer than 2 to 4 hours at one time. (Typically this will be at the time of initial installation of OBIS laser(s) into the OBIS Galaxy Beam Combiner.)
   - After 12 to 24 months of use, depending on relative humidity, temperature, and number of times the cover has been removed.

Figure 13-15. Add NEW Desiccant Packets

6. Using the 7/64" hex wrench, secure the OBIS Galaxy box cover by firmly tightening the six top cover screws ***in the sequence shown in*** Figure 13-16.

   The following torquing specifications are RECOMMENDED:

   - FIRST, torque all the screws to 5 in-lb.
   - SECOND, torque all the screws to 9in-lb.

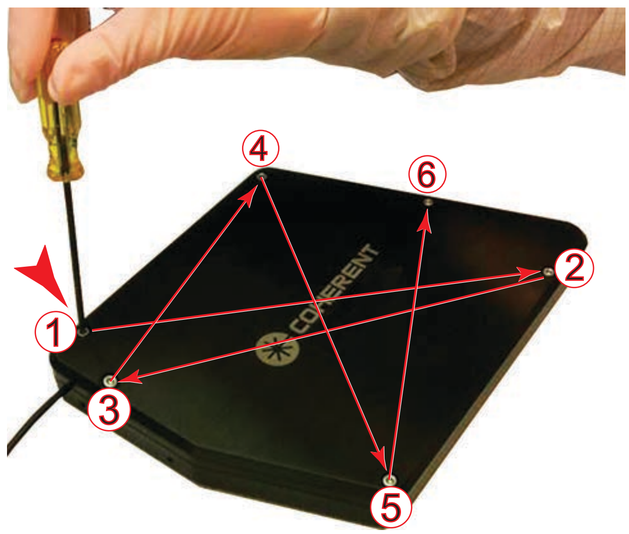


Figure 13-16. Tightening Pattern to Secure Cover

Remove a Laser from the OBIS Galaxy

This section describes how to remove a laser from the OBIS Galaxy. Throughout this procedure the OBIS LX laser is used as an example.

WARNING!
Turn off all lasers before starting this procedure.

NOTICE!
Only turn on laser power when the fiber is connected. Cleaning the Fiber connector while the laser is on can damage the connector.

NOTICE!
This procedure must be done in a clean environment (flow bench or clean room) in normal humidity and temperature conditions

NOTICE!
The OBIS FP/UFC laser has a FC/UFC connector. To prevent permanently destroying the OBIS Galaxy fiber-coupling alignment, DO NOT plug any other type of fiber connector into the OBIS Galaxy.

NOTICE!
Always **clean the sleeve and connector completely** ***before*** **plugging in the fiber. Coupling visible light into a single-mode fiber is very sensitive to part cleanliness.**

NOTICE!
Do not loosen, adjust, or remove the output fiber. This connector is factory aligned and is not intended to be adjusted in any manner. Adjusting the output fiber will void the warranty and reduce performance of the OBIS Galaxy Beam Combiner.

Tools and Supplies Needed

The tools and supplies shown in Figure 13-17 are needed to remove a laser from the OBIS Galaxy Beam Combiner.

Figure 13-17. Tools & Supplies to Remove Laser from OBIS Galaxy

- 5/64” hex wrench
- 7/64” hex wrench
- Tweezers
- Specialized swabs for optics cleaning (example: CleanTips Swabs TX759B)
- 4 desiccant packets, Coherent P/N 1233443 (Tri-Sorb®, 2 g)
- Clean room gloves (example: TechNitrile from TechNiGlove International)
- Optics grade methanol/isopropanol
- Torque wrench (optional—not shown in Figure 13-17)

Removal Procedure

To remove a laser from the OBIS Galaxy Beam Combiner:

1. Using the 7/64” hex wrench, take out the six top cover screws and remove the cover, as shown in Figure 13-18.

Figure 13-18. Remove cover

NOTICE!
The Galaxy box cover must not be open for more than a few hours in normal humidity and temperature conditions.

---

2. Discard the desiccant packets, as shown in Figure 13-19.

Figure 13-19. Discard Desiccant Packets

3. Using the 5/64” hex wrench, take out the two strain relief screws and remove the strain relief, as shown in Figure 13-20.

Figure 13-20. Remove Strain Relief Screws

4. Using the tweezers, carefully lift the rubber seal from the fiber channel, as shown in Figure 13-21.

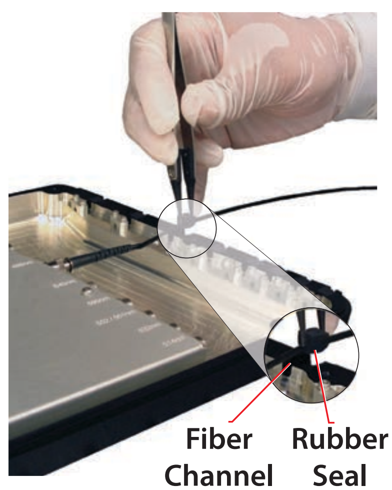


Figure 13-21. Remove Rubber Seal

5. Loosen the FC connector and *carefully* slide the fiber out of the sleeve, as shown in Figure 13-22.

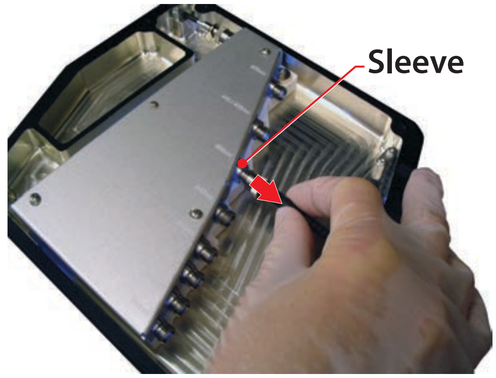


Figure 13-22. Slide Fiber Out of the Sleeve

6. Using the tweezers, replace the rubber seal in the empty fiber channel, as shown in Figure 13-23.

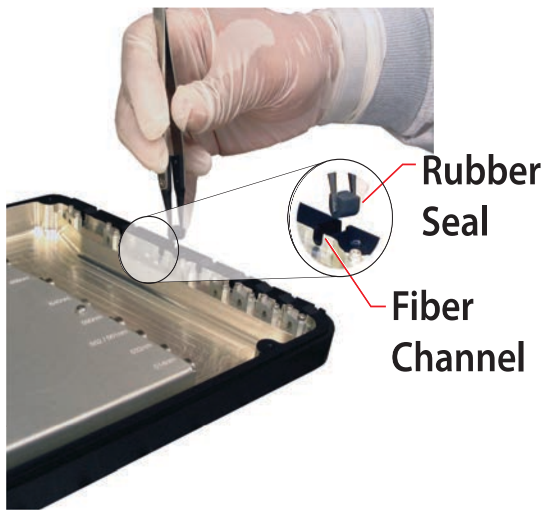


Figure 13-23. Replace Rubber Seal

7. Using the 5/64" hex wrench, secure the strain relief using the two screws previously removed, as shown in Figure 13-24.

Figure 13-24. Replace Strain Relief Screws

8. Add four new desiccant packets, as shown in Figure 13-25.

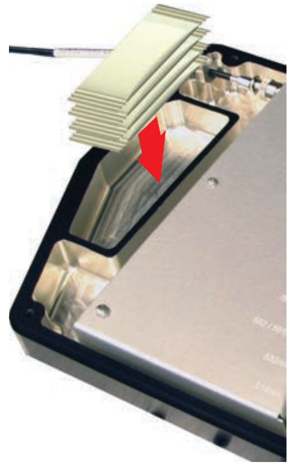


Figure 13-25. Replace Desiccant Packets

It is recommended to change the desiccant packets when:

- The OBIS Galaxy cover has been removed for longer than 2 to 4 hours at one time. (Typically this will be at the time of initial installation of OBIS laser(s) into the OBIS Galaxy Beam Combiner.)
- After 12 to 24 months of use, depending on relative humidity, temperature, and number of times the cover has been removed.

9. Using the 7/64" hex wrench, secure the OBIS Galaxy box cover by firmly tightening the six top cover screws ***in the sequence shown in*** Figure 13-26.

   The following torquing specifications are RECOMMENDED:

   - FIRST, torque <u>all</u> the screws to 5 in-lb.
   - SECOND, torque <u>all</u> the screws to 9 in-lb.

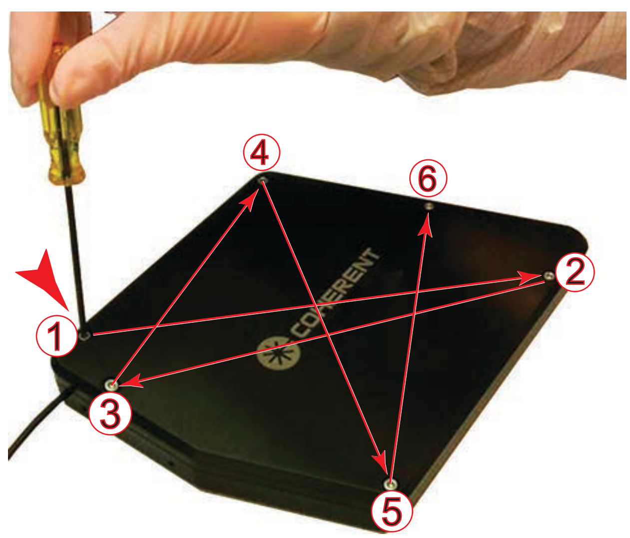


Figure 13-26. Tightening Pattern for Cover

— END OF PROCEDURE —

Dimensions

Figure 13-27 shows the dimensions for the OBIS Galaxy Beam Combiner.

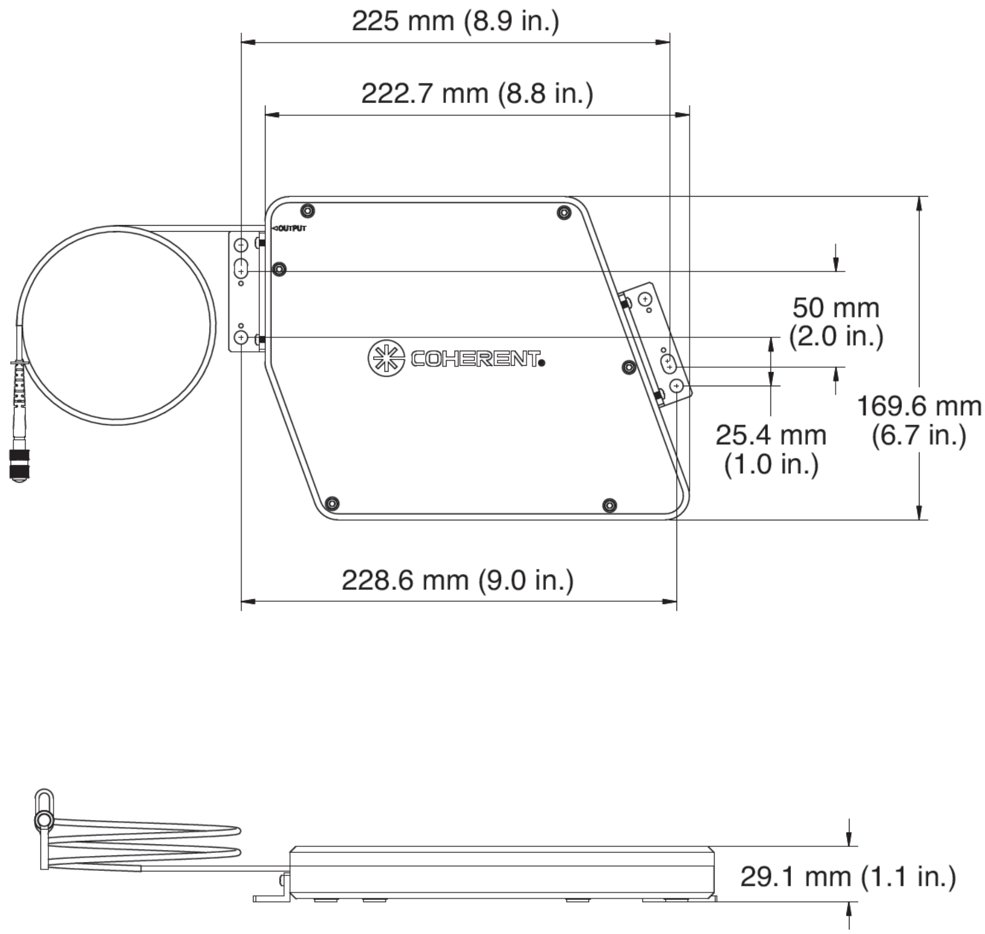


Figure 13-27. OBIS Galaxy Dimensions

Specifications

For current specifications for the OBIS Galaxy Beam Combiner, go to the Coherent website at:

https://cohrcdn.azureedge.net/assets/pdf/COHR_OBIS_Galaxy.pdf

OBIS Galaxy Tutorial

A short video tutorial is available to show how to set up an OBIS Galaxy Beam Combiner, which enables up to eight multi-wavelength OBIS LX/LS FP and Sapphire FP lasers.

To view this tutorial, go to:

https://www.youtube.com/watch?v=vepaOw8d_qk

Repacking Procedure

1. Attach the OBIS Galaxy to the shipping plate using the three socket head cap screws, as shown in Figure 13-28.

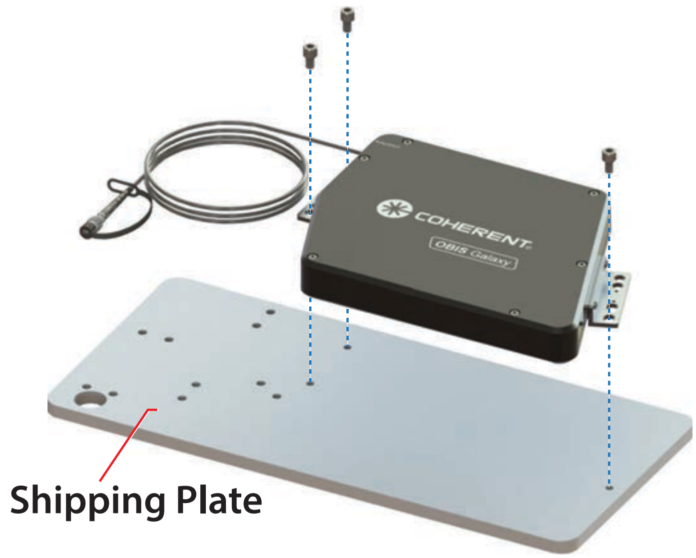


Figure 13-28. Secure OBIS Galaxy to Shipping Plate

2. Coil the output fiber to the correct diameter to fit the plate (about seven coils) and attach it to the shipping plate with five zip ties, as shown in the example in Figure 13-29.

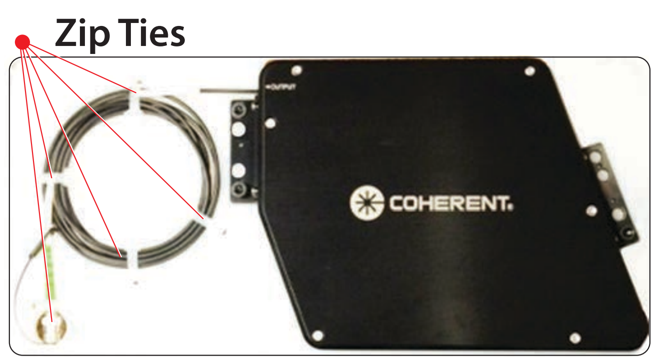


Figure 13-29. Attach Fiber with Zip Ties

3. Place the shipping plate with the attached Galaxy into the ESD bag, as shown in Figure 13-30.

Figure 13-30. Place OBIS Galaxy in ESD Bag

4. If applicable, place the accessories and the manual into the lower insert. Place the insert into the bottom of the shipping box on top of those pieces, as shown in Figure 13-31.

Figure 13-31. Place Lower Insert into Shipping Box

5. Place the OBIS Galaxy unit into the other insert and fold the side flaps down to tighten the film, as shown in Figure 13-32.

Figure 13-32. Place OBIS Galaxy into the Shipping Box

6. Place the upper insert with the OBIS Galaxy into the shipping box, as shown in Figure 13-33.

Figure 13-33. Place Upper Insert into Shipping Box

7. Close the shipping box and secure the box with tape, as shown in Figure 13-34.

Figure 13-34. Close and Secure Shipping Box

8. *If you are returning the system to Coherent for service*:
   - Contact Coherent Customer Service (1.800.343.4912) to get a RMA number.
   - Include the RMA number on the shipping label.

Troubleshooting Procedures

Shown below are possible problems, with a reference to the related troubleshooting checklist.

Table 13-2. OBIS Galaxy Beam Combiner Troubleshooting Procedures

PROBLEM	REFERENCE
Low power throughput (%)	Checklist 1 (this page)

Checklist 1: Low power throughput (%)

If the OBIS LX/LS FP Galaxy or Sapphire FP Galaxy laser output power—Power Throughput (%)—is below specifications, do the following steps in the order shown prior to sending the OBIS Galaxy Beam Combiner back for service evaluation.

[ ] Make sure to install a laser into the OBIS Galaxy Beam Combiner in a clean environment (such as a clean room or under a flow bench).

Optical cleanliness is essential to achieving and maintaining maximum output power throughput. It is important to use clean room-grade Nitrile gloves, optics-grade methanol/isopropanol, and optical swabs designed for fiber optic cleaning.

[ ] Confirm the OBIS Galaxy laser FC connector key is properly aligned to the mating connectors sleeve keyway. Carefully slide the fiber ferrule into the mating sleeve using a gentle clockwise and counter-clockwise rotation until the fiber is fully inserted while tightening the collar on the FC connector.

[ ] Ensure that a proper power measurement instrument is used to monitor and measure the output power and stability of both the laser output and the OBIS Galaxy Output Fiber.

Coherent recommends that you use a fast responding power sensor/meter system—such as a PowerMax-USB UV/VIS Quantum Power Sensor—to monitor and measure the output power of both a Coherent Galaxy laser and the OBIS Galaxy Output Fiber Power. For more information, see “Appendix J: Power Measurement Instrumentation” (p. J-1).

[ ] Inspect the output fiber tip to ensure it is clean and free of damage. Properly inspecting the fiber tip requires a desktop fiber optic microscope or a hand-held fiber optic microscope. For further details, refer to “Fiber Tip Inspection” (p. 3-13).

[ ] Contact Coherent Technical Support—refer to “Introduction” (p. 8-1) for contact information.

Appendix A: 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.

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.

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.

APPENDIX B: OBIS ACCESSORIES PARTS LIST

This section lists the accessories you can order for the OBIS laser system. Also see information about OBIS Accessories on the Coherent website at:

https://www.coherent.com/lasers/main/obis-accessories

The parts listed in this section can be ordered as follows:

- Call the Technical Support Hotline at 1.800.367.7890 (1.408.764.4557 outside the U.S.)
- Send an e-mail to Product.Support@Coherent.com
- Contact your local Coherent service representative (see www.Coherent.com 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.

Table B-1 lists the parts for the OBIS laser system that you can order.

Table B-1. Parts List

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)
1190582	OBIS Power Cable to Flying Leads, 2-pin Molex
1106344	Power Cord, USA, wall plug to IEC-60320 plug, 8 foot
1150025	Power Cord, European, wall plug to IEC-60320 plug, 8 foot
1173961	OBIS Remote, Single Laser (includes power supply with USA-style power cord) (does not include laser-to-remote SDR cable - order separately)
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
1203909	OBIS Remote, 6-Laser (includes power supply and six (6) laser power cables)
1193289	OBIS Heatsink Mount with fan
1190901	OBIS Interlock Laser Warning Light Assy for OBIS Remote
1190348	OBIS Accessory Spare Parts for OBIS Remote (includes power cable, USB Flash Drive, I/O cable, keys, labels, and interlock)
1214875	OBIS Remote, Single Laser, with power supply (includes SDR laser-to-remote cable (1 meter) and USA power cord)
1211389	OBIS 6-Laser Power Supply, 110V/220 VAC, 12 VDC, IEC-320 input (does not include power cord to wall - order separately)
1108906	USB Cable, 1.8 meter (USB Type A to Type Mini B)
1211797 (see p. E-1)	OBIS SDR Break-out-PCBA

Table B-1. Parts List (continued)

PART NUMBER	DESCRIPTION (CONTINUED)
1234465	OBIS Scientific Remote (does not include SDR cables)
1234466	OBIS Scientific Remote (includes six 1-meter SDR cables)
1254255	OBIS Galaxy Output Fiber (FC/UFC to FC/APC)
1319290	OBIS SDR-to-SMB Adapter Kit, dip switch

APPENDIX C: HOST INTERFACE

In this section:

- Host command quick reference (this page)
- Message considerations (p. C-3)
- Master commands and queries (p. C-7)
- Controls and queries (p. C-26)
- System standby and sleep mode (p. C-32)
- OBIS RS-232 interface (p. C-32)

NOTICE!
When a command is sent to the OBIS system, the parameter for the command is stored in internal persistent memory. Internal persistent memory has a logic cell life of one million cycles for the laser or 10,000 cycles for the OBIS Remote. The cell life sets the limits for repetitive commands sent to the OBIS system.

This information only applies to commands and not queries.

Host Command Quick Reference

To download the current Coherent Connection software that supports OBIS LX and LS lasers, go to:

https://cohrstage.coherent.com/assets/software/Coherent_Connection_Setup_3.0.0.8.exe

Table C-1 briefly describes all host commands and queries. For specific command or query details, refer to the page listed in the right column.

Table C-1. Host Command Quick Reference

COMMAND	DESCRIPTION	PAGE NO.
MANDATORY COMMANDS/QUERIES		
IEEE-488.2		
*IDN?	Gets the laser's identification string	C-8
*RST	Causes a device to warm boot if implemented	C-8
*TST?	Runs a laser self-test procedure, if implemented	C-9
SESSION CONTROL		
SYSTem:COMMunicate:HANDshaking	Toggles the system handshaking	C-11
SYSTem:COMMunicate:HANDshaking?	Queries the system handshaking	C-11
SYSTem:COMMunicate:PROMpt	Toggles the system command prompt	C-12
SYSTem:COMMunicate:PROMpt?	Queries the system command prompt	C-12
SYSTem:AUTostart	Enables or disables the laser Auto Start feature	C-12
SYSTem:AUTostart?	Queries the laser Auto Start feature	C-12

Table C-1. Host Command Quick Reference (continued)

COMMAND	DESCRIPTION	PAGE NO.
SYSTem:INFormation:AMODulation:TYPe	Sets the analog modulation type	C-12
SYSTem:INFormation:AMODulation:TYPe?	Queries the analog modulation type	C-12
SYSTem:STATus?	Queries the system status	C-12
SYSTem:FAULt?	Queries current system faults	C-14
SYSTem:INDicator:LASer	Turn ON/OFF laser status indicator(s)	C-15
SYSTem:INDicator:LASer?	Queries laser status indicator(s)	C-15
SYSTem:ERRor:COUNt?	Queries the number of error records in the error queue	C-16
SYSTem:ERRor:NEXT?	Queries the next error record(s) in the error queue	C-16
SYSTem:ERRor:CLEar	Clears all error records in the error queue	C-16
OBIS COMMON COMMANDS/QUERIES		
SYSTEM INFORMATION		
SYSTem:INFormation:MODel?	Retrieves the model name of the laser	C-18
SYSTem:INFormation:MDATe?	Retrieves the manufacture date of the device	C-18
SYSTem:INFormation:CDATe?	Retrieves the calibration date of the device	C-18
SYSTem:INFormation:SNUMber?	Retrieves the serial number of the laser	C-18
SYSTem:INFormation:PNUMber?	Retrieves the manufacturer part number of the laser	C-18
SYSTem:INFormation:FVERsion?	Retrieves the current firmware version	C-18
SYSTem:INFormation:PVERsion?	Retrieves the current OBIS protocol version	C-19
SYSTem:INFormation:WAVelength?	Retrieves the wavelength of the laser	C-19
SYSTem:INFormation:POWer?	Retrieves the power rating of the laser	C-19
SYSTem:INFormation:TYPe?	Retrieves the device type	C-19
SOURce:POWer:NOMinal?	Returns the nominal CW laser output power	C-19
SOURce:POWer:LIMit:LOW?	Returns the minimum CW laser output power	C-19
SOURce:POWer:LIMit:HIGH?	Returns the maximum CW laser output power	C-20
SYSTem:INFormation:USER	Enters and stores user-defined information	C-20
SYSTem:INFormation:USER?	Queries user-defined information	C-20
SYSTem:INFormation:FCDate	Enters and stores date of last field calibration	C-20
SYSTem:INFormation:FCDate?	Queries date of last field calibration	C-20
SYSTEM STATE		
SYSTem:CYCLes?	Returns the number of ON/OFF power cycles	C-20
SYSTem:HOURs?	Returns the hours the laser has been powered on	C-20
SYSTem:DIODe:HOURs?	Returns the hours the laser diode has operated	C-21
SOURce:POWer:LEVel?	Returns the present output power of the laser	C-21
SOURce:POWer:CURRent?	Returns the present output current of the laser	C-21
SOURce:TEMPerature:BASeplate?	Returns the present laser base plate temperature	C-21
SYSTem:LOCK?	Returns the status of the system interlock	C-21
OPERATIONAL		
SOURce:AM:INTernal	Sets the laser operating mode to internal CW	C-22
SOURce:AM:EXTernal	Sets the laser operating mode to external modulation	C-22
SOURce:AM:SOURce?	Queries the current operating mode of the laser	C-22

Table C-1. Host Command Quick Reference (continued)

COMMAND	DESCRIPTION	PAGE NO.
SOURce:POWer:LEVel:IMMediate:AMPLitude	Sets present laser power level	C-22
SOURce:AM:STATe	Turns the laser ON or OFF	C-23
SOURce:AM:STATe?	Queries the current laser emission status	C-23
SYSTem:CDRH	Enables or disables the CDRH laser emission delay	C-23
SYSTem:CDRH?	Queries the status of the CDRH laser emission delay	C-23
OBIS OPTIONAL COMMANDS/QUERIES		
SOURce:TEMPerature:APRobe	Enables/disables temperature control of the laser diode	C-23
SOURce:TEMPerature:APRobe?	Queries temperature control of the laser diode	C-23
OBIS LX-Specific Commands/Queries		
SOURce:POWer:CALibration	Starts a self-laser power calibration	C-24
SOURce:POWer:UNCalibration	Undoes the filed calibration	C-24
SOURce:AModulation:BLANKing	Enables/disables Blanking in Analog Modulation mode	C-24
SOURce:AModulation:BLANKing?	Queries present state of Analog Modulation Blanking	C-24
SOURce:TEMPerature:PROTection:INTernal:HIGH?	Queries the high internal temperature limit settings	C-24
SOURce:TEMPerature:PROTection:INTernal:LOW?	Queries the low internal temperature limit settings	C-24
SOURce:TEMPerature:DIODe?	Queries the present laser diode temperature	C-25
SOURce:TEMPerature:DSETpoint?	Queries the diode set point temperature	C-25
SOURce:TEMPerature:INTernal?	Queries the present internal laser temperature	C-25

The following table shows an example of the command/query for the indicator status light on the top cover of the OBIS:

Table C-2. 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.

In a similar fashion, use commands and queries with the appropriate value after the command and a space between the command and the value. To query the laser, add a question mark (?) at the end of the command.

Message Considerations

Communication Port Selection

The laser design includes both USB and Coherent Connection Bus (CCB) communication ports.

The communication protocol described within this section works identically on either port; however, the ports are mutually exclusive and cannot be used simultaneously.

When both USB and CCB connections are connected, the laser gives the CCB port precedence and ignores any input received from the USB port. Note that certain information on the laser/controller communications—such as one controller talking to multiple lasers—is part of future expansion protocol and is not applicable to the OBIS Remote.

Message Completion Handshake

Standard commands for programmable instrument (SCPI) message round trip handshaking is implemented on every message sent by the laser firmware; however, the handshaking may be disabled using an SCPI command. Change of the setting will be saved in non-volatile memory.

This handshake serves several purposes:

1. It provides an indication to the host/controller that the message was received.
2. It provides a synchronization mechanism to the host/controller so it will know when a message has been processed to completion so a new message may be sent.
3. It provides the host/controller with an indication of any errors that may have occurred.

The handshake is a short message string that is sent as the last action performed when handling a received message. The handshake string represents either an OK response or an error response if a received message raises an error condition.

Note that quotation marks as depicted here are never included in the handshake string.

- The OK response is formatted as: **`OK\r\n`**
- Error responses are formatted as follow, where <n> represents the error code number: **`ERR<n>\r\n`**

Negative numbers are permitted in the error string.

When handshaking is enabled, OBIS devices transmit one of the following handshake reply strings in response to each received command or query:

- Valid commands with valid data parameters will reply with **`OK\r\n`**.
- Valid queries with any optional valid data reply as explicitly defined elsewhere in this section, followed by **`OK\r\n`**. For example, if querying the model name string, the laser will transmit the model name string followed by the **`OK\r\n`** string.
- Valid commands or queries which result in an error reply with **`ERR<n>\r\n`**.
- Unrecognized or unsupported commands or queries reply with **`ERR<n>\r\n.`**

Note that the message completion handshake is not transmitted in response to a command that has been broadcast to all devices.

Message Terminators

Messages between the laser and the host computer or controller are comprised entirely of ASCII string characters; no binary messages are supported. All message strings passing through the host interface are terminated to signal the end of a message string. The maximum message length supported is 255 bytes, which includes all terminating characters.

Messages Received by the Laser

Messages received by the laser must be terminated by a carriage return (decimal 13). A line feed (decimal 10) following the carriage return is ignored so messages may be terminated with a carriage return and line feed pair. A command or query is considered incomplete without proper termination.

Messages Sent by the Laser

All messages sent by the laser are terminated by a carriage return (decimal 13) and line feed (decimal 10) pair. The maximum length of any message sent by the laser is limited to 255 bytes, including all terminating characters.

Message Syntax

Syntax specified by the SCPI and IEEE 488.2 Standards is followed unless otherwise specified. Refer to the SCPI and IEEE 488.2 Standards for more information.

Notably, the base-10 numeric data format specification is used heavily in this document and covered in the IEEE 488.2 Standard. Unless otherwise specified, numeric data items referred to as NRf (IEEE flexible numeric representation) are interchangeable and may be represented in any of these formats:

- integer values
- non-scientific notation floating point values
- scientific notation floating point values (uppercase or lowercase E)

For example, the following data values are functionally equivalent:

- 31256
- 31256.0
- 3.1256E4
- 31.256E3
- +3.1256E+4.

Unless otherwise specified, non-numeric data items (typically referred to as strings) are not quoted.

Devices interpret hexadecimal data using the following rules:

- Uppercase and lowercase are accepted (“**`FE`**” is the same as “**`fe`**”)
- Leading zeroes are required and accepted (“**`0A`**” is the same as “**`A`**”)
- The data string may optionally be preceded by a “**`0x`**” or “**`0X`**” C hexadecimal notation idiom (**`0xD2C4`** is the same as **`D2C4`**)
- Following the optional “**`0x`**” prefix, the acceptable characters are from the list: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f, A, B, C, D, E, and F

Enumerated values must match exactly, using the long form/short form comparison rules defined under the SCPI Standard.

Dates (manufacturing date, calibration date, etc.) will use the **`YYYYMMDD`** format. Using this format, dates may be stored as ASCII strings or as numeric long integers and converted easily from one format to the other.

Device Selection Syntax

Many common commands are supported by all OBIS devices. When such a command is transmitted by a host computer to a system of devices (a controller and one or more lasers), an ambiguity exists where the exact destination device is not clear.

The SCPI protocol provides a method to communicate with multiple virtual devices within an instrument. Since a complete OBIS system could be considered an "instrument" (controller) with multiple "virtual devices" (lasers) this mechanism is used to disambiguate the destination of a command.

A SCPI command consists of one or more words separated by delimiters. The first word in a command string is called the base word.

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.

As an implementation detail, lasers should always respond to commands with either no suffix or suffixes of 0 or 255 to accommodate connections to a bus and also directly to a host computer.

When host commands are routed through an OBIS controller, the numeric suffix will be stripped off before the command is transmitted to a laser. In this instance, the laser does not have to deal with the numeric suffix at all and can behave as if it were connected directly to a host.

However, when a laser is connected directly to a host, then it is valid for the host to append a 0 to the command base word to refer to the first connected device. Since that device could be a laser, the laser will support a numeric suffix of 0.

The numeric suffix of 255 refers to a command (not query) that is broadcast to all devices on the bus. Queries cannot be broadcast since a stream of query results won't make any sense to the host. Therefore, the command **`SYSTem255:PROMpt ON`** enables the system prompt for all devices while **`SYSTem0:PROMpt ON`** enables the prompt for the first connected device.

Command Prompt

Each device implements the ability to output a command prompt to support interactive operation by an operator typing commands in a terminal program. A command has been specified to describe the command prompt behavior.

Note that the command prompt will not be transmitted in response to a command that has been broadcast to all devices.

Broadcast Commands

It is possible that a host message could be broadcast to all attached devices. Generally the broadcast capability is best used when a command is needed to synchronize the action of a group of devices (such as turning all connected lasers on or off simultaneously). The ability to broadcast device queries is prohibited.

Lasers silently ignore any query that is broadcast and will act upon a broadcast command, if possible, without transmitting anything in response (including error, handshake, or command prompt strings).

Controllers respond to queries that are broadcast by returning error 103 along with optional handshake and command prompt strings.

Controllers respond to commands that are broadcast by rebroadcasting them to all devices on the bus, performing the broadcast action locally if appropriate for the command, and then returning any optional handshake and command prompt strings to the host.

This method allows the host to receive a single handshake and/or command prompt when a command is broadcast to several devices.

Commands and Queries

The OBIS Laser Protocol supports three types of laser devices:

- OBIS LX direct diode lasers (DDL)
- OBIS LS optically pumped semiconductor lasers (OPSL)
- Other similar accessories

Each of these laser types support the common command sets and zero or more of the extension command sets, as shown in Table C-3.

Table C-3. Supported Commands by Laser Type

COMMAND SET	OBIS LX (DDL)	OBIS LS (OPSL)	OTHER
SCPI Common Command Set	X	X	X
OBIS Common Command Set	X	X	X
OBIS LX Extension Command Set	X	—	—
OBIS LS Extension Command Set	—	X	—

Mandatory Commands and Queries

This section describes the mandatory commands and queries.

IEEE-488.2 Mandated Commands and Queries

The SCPI Standard specifies a mandatory set of IEEE-488.2 common commands. All of these commands and queries start with an asterisk. Refer to the IEEE-488.2 specification for more detailed information concerning these commands.

*Identification Query - *IDN?*

Gets the laser's identification string, such as model name, firmware version, and firmware date.

QUERY	`*IDN?`
REPLY	`"Coherent, Inc" + "-" + <model name> + "-" + <firmware version> + "-" + <firmware date>`

The dash sign separates all fields within the reply string.

- The first field will always be "Coherent, Inc".
- The second field is the model name, which varies based on the laser.
- The third field is the firmware version number, having the format "V<major>.<minor><optional qualifier characters>".
- The fourth field is the firmware date, having the form YYYYMMDD.

The reply string is not quoted.

For example, a typical identification string might look like:

```
Coherent, Inc-OBIS 405nm 50mW C-1.3-
20090630
```

*Reset Command - *RST*

Causes a device to warm boot if implemented. Note that the message handshake is transmitted immediately prior to execution of the reset.

If the command is not implemented, then no error is returned and no response is necessary.

QUERY	`*RST`
REPLY	None

Self-test Query - *TST?

Runs a laser self-test procedure, if implemented. Any detected faults are set in the laser fault code, listed in Table C-4.

QUERY	`*TST?`
REPLY	`<System Fault Code>`

The returned system fault code is formatted as a 32-bit hex value. A value of 0 indicates no fault conditions. If the self-test is not implemented, a value of `0xffffffff` is returned.

Table C-4 lists the fault codes for the OBIS remote and OBIS lasers.

NOTE:
A warm or cold device reboot is required to clear an OBIS Remote or laser fault.

Table C-4. Fault Codes—OBIS Remote and Laser

CODE BIT[A]	ERROR VALUE	OBIS REMOTE	LASER	ERROR DESCRIPTION	CAUSE AND POSSIBLE SOLUTION
0	00000001		X	Baseplate temperature fault	**Cause**: Baseplate temperatures is greater than 40°C or lower than 10°C. **Solution**: Improve heatsink to reduce baseplate temperature or adjust the ambient temperature where the laser operates.
1	00000002		X	Diode temperature fault	**Cause**: Diode temperature is greater than 40°C or lower than 10°C. **Solution**: Make sure the TE cooler is on and/or adjust the ambient temperature where the laser operates.
2	00000004		X	Internal temperature fault	**Cause**: Microprocessor temperature exceeds factory set limit. **Solution**: Make sure the TE cooler is on and the ambient temperature is within the specified range.
3	00000008		X	Laser power supply fault	**Cause**: There is no electrical power to the laser diode. **Solution**: Make sure the SDR cable is plugged in and secured properly on both ends.
4	00000010		X	Device internal I2C bus error	**Cause**: An error was encountered in internal I2C bus communications. **Solution**: Perform a warm or cold reboot of the laser system. If the problem persists, contact Coherent technical support.
5	00000020		X	Laser diode over-current error	**Cause**: Laser diode current exceeds the specified upper limit. **Solution**: Turn off laser emission and reboot the device. If the problem persists, contact Coherent technical support.
6	00000040		X	Laser checksum error	**Cause**: An error occurred that is associated with persistent memory where critical data is stored. **Solution**: Reboot the laser system. If the problem persists, contact Coherent technical support.

Table C-4. Fault Codes—OBIS Remote and Laser (continued)

Code Bit[A]	Error Value	OBIS Remote	Laser	Error Description	Cause and Possible Solution
7	00000080		X	Checksum recovery error	**Cause**: An error occurred when trying to recover from checksum error via host command. **Solution**: Contact Coherent technical support.
8	00000100		X	Message buffer overflow	**Cause**: An overflow error associated with message buffer was encountered in the firmware. **Solution**: Perform a warm or cold reboot of the laser system. If the problem persists, contact Coherent technical support.
9	00000200		X	Warm-up limit fault	**Cause**: The 5-minute warm-up limit was exceeded. **Solution**: Make sure the TE cooler is enabled. If the laser was started in a very low temperature environment, keep the laser powered for 10-15 minutes, then reboot the device.
10	00000400		X	TEC control error	**Cause**: An error associated with the TEC operation was encountered. It can be caused by insufficient heatsink. **Solution**: Make sure heatsink is sufficient, then perform a device reboot. If the problem persists, contact Coherent technical support.
11	00000800		X	Coherent Connection bus error	**Cause**: An error associated with RS485 bus communications between the laser and OBIS Remote was encountered. **Solution**: Make sure the SDR cable is plugged in and secured properly on both ends.
12	00001000		X	Diode temperature limit error	**Cause**: Laser diode temperature deviates from the temperature set point by more than 3°C. **Solution**: Make sure the TE cooler is turned on. If the laser warm-up process is disabled, keep the laser running for 10-15 minutes, then perform a device reboot.
13	00002000		X	Laser ready fault	**Cause**: Laser fails to emit within ± 2% of the requested power. **Solution**: If the problem persists, contact Coherent technical support for a system recalibration.
14	00004000		X	Photodiode fault	**Cause**: Readings from the internal photodiode for power control were negative. **Solution**: Reboot the laser. If the problem persists, Contact Coherent technical support.
15	00008000		X	Device fatal error	**Cause**: A device error not recoverable in the field if persistent. **Solution**: If the problem persists, contact Coherent technical support.
16	00010000		X	Startup error	**Cause**: Errors were encountered during firmware start-up. **Solution**: Perform a cold or warm device reboot.

Table C-4. Fault Codes—OBIS Remote and Laser (continued)

Code Bit[a]	Error Value	OBIS Remote	Laser	Error Description	Cause and Possible Solution
17	00020000		X	Watchdog timer reset	**Cause**: Firmware was resumed from a processor watchdog reset. **Solution**: Contact Coherent technical support.
18	00040000		X	Field calibration error	**Cause**: Errors were encountered while running power field calibration. **Solution**: Re-run field calibration. If the problem persists, contact Coherent technical support.
20	00100000		X	Overpower fault	**Cause**: Error occurs when actual power is 10% over the maximum power setting. **Solution**: Perform a cold or warm device reboot. If the problem persists, contact Coherent technical support.
...	...	...	...	...	…
30	40000000	X		Min-controller checksum error	**Cause**: An error associated with persistent memory was encountered. **Solution**: Reboot the OBIS Remote. If the problem persists, contact Coherent technical support.
31	80000000	X		Fault status from OBIS Remote	**Cause**: A firmware or hardware fault was encountered in the OBIS Remote. **Solution**: Reboot the OBIS Remote. If the problem persists, contact Coherent technical support.

a. Unspecified bits are reserved and will be zero.

OBIS Mandatory Commands and Queries

The OBIS Mandatory Command set is implemented by all OBIS compatible devices.

Session Control Commands

Handshaking

Toggles the system handshaking on and off. Setting is saved in persistent memory. The factory default is ON.

Command	`SYSTem:COMMunicate:HANDshaking {ON|OFF}`
Query	`SYSTem:COMMunicate:HANDshaking?`
Reply	`ON|OFF`

When enabled, the device transmits, in response to each received command or query, one of the handshaking strings described under “Message Completion Handshake” (p. C-4).

Note that the handshaking reply is not transmitted in response to a command that has been broadcast to all devices, except by a controller device.

Command Prompt

Toggles the system command prompt on and off. Setting is saved in persistent memory. The factory default is OFF.

COMMAND	`SYSTem:COMMunicate:PROMpt {ON|OFF}`
QUERY	`SYSTem:COMMunicate:PROMpt?`
REPLY	`ON|OFF`

When enabled the device outputs a command prompt after each reply string. The command prompt is preceded by a carriage return and line feed, and consists of a '>' character and a space character.

Note that the command prompt is not transmitted in response to a command that has been broadcast to all devices, except by a controller device.

Laser Auto Start

Enables or disables the laser Auto Start feature. Setting is saved in persistent memory. The factory default is OFF.

COMMAND	`SYSTem:AUTostart {ON|OFF}`
QUERY	`SYSTem:AUTostart?`
REPLY	`ON|OFF`

If Auto Start is enabled, the device, when powered up, will automatically start emission at a previously-set level.

The Auto Start setting is saved in the non-volatile memory of the laser. If the laser is connected to a OBIS Remote through a SDR cable, this setting is overridden by the hardware switch of the min-controller; however, the ON/OFF position of the switch will not overwrite the setting in the laser memory.

Analog Modulation Type

Sets the analog modulation type that provides unique electrical impedance on the analog interface of the OBIS Remote. The factory default is 50Ω.

COMMAND	`SYSTem:INFormation:AMODulation:TYPe {1|2}`
QUERY	`SYSTem:INFormation:AMODulation:TYPe?`
REPLY	`1|2`

The input impedance is 50Ω and 2 kΩ for type 1 and 2, respectively.

System Status Query

Gets the system status code. The status code is returned in a string expressed in uppercase hexadecimal integer form. The 32-bit word represents a bit-mapped status indicator.

The MSB of the code is used to indicate if the code represents the status of a controller or a laser. If the MSB is set, the code represents controller status. This is important since the meaning of some bits is subtly different for a controller.

Table C-5 describes status code bit mapping. The “Controller” column specifies the meaning of each bit when the status word is read from the controller and the “Laser” column specifies the bit meaning when the status word is read from a laser. The status word MSB indicates whether a status word is from a laser or from a controller.

Table C-5. Status Code Bit Definitions

Bit	Mask	Bit Label	Controller	Laser
0	00000001	Laser Fault	Logical OR from all lasers	Laser faults—that is, fault words shown in Table C-6 (p. C-14)
1	00000002	Laser Emission	Logical OR from all lasers	Laser emission status
2	00000004	Laser Ready	Logical OR from all lasers	Laser ready status
3	00000008	Laser Standby	Logical OR from all lasers	Laser standby status
4	00000010	CDRH Delay	Logical OR from all lasers	Laser CDRH delay status
5	00000020	Laser Hardware Fault	Logical OR from all lasers	Hardware related faults in Table C-6 (p. C-14)
6	00000040	Laser Error	Logical OR from all lasers	Laser error is queued
7	00000080	Laser Power Calibration	Logical OR from all lasers	Laser power is within factory calibration specification
8	00000100	Laser Warm Up	Logical OR from all lasers	Laser warm-up status
9	00000200	Laser Noise	Logical OR from all lasers	Noise level is over 30
10	00000400	External Operating Mode	Logical OR from all lasers	External operating mode is selected
11	00000800	Field Calibration	Logical OR from all lasers	Field calibration is in progress when set
12	00001000	Laser Power Voltage	Logical OR from all lasers	12V laser power voltage is present when set
...	…	…		
25	02000000	Controller Standby	Keyswitch is in “STANDBY” position	Always 0
26	04000000	Controller Interlock	“INTERLOCK” is open.	Always 0
27	08000000	Controller Enumeration	One or more lasers have been enumerated	Always 0
28	10000000	Controller Error	Controller error flag	Always 0
29	20000000	Controller Fault	Controller fault status	Always 0

Table C-5. Status Code Bit Definitions (continued)

BIT	MASK	BIT LABEL	CONTROLLER	LASER
30	40000000	Remote Active	Host is connected	Always 0
31	80000000	Controller Indicator	Status word is from controller.	Always 0

Unspecified bits are reserved and are zero.

COMMAND	`None`
QUERY	`SYSTem:STATus?`
REPLY	`<status word>`

As an example, if the laser is turned on, but is being delayed by the CDRH required delay, the system status query returns:

`00000012` (*Laser emission enabled but delayed by CDRH*)

System Fault Query

Gets the system fault code. The fault code is returned in a string expressed in uppercase hexadecimal integer form. The 32-bit word represents a bit-mapped fault indicator.

COMMAND	`None`
QUERY	`SYSTem:FAULt?`
REPLY	`<fault word>`

As an example, if the base plate and laser diode temperature limits are both exceeded, the system fault query will return:

`00000003` (*Base Plate & Laser Diode Temp. Limits Exceeded*)

The Most Significant Bit (MSB) of the code is used to indicate if the code represents the status of a controller or a laser. If the MSB is set, the code represents controller fault status. This is important since the meaning of some bits is subtly different for a controller.

Table C-6 describes fault code bit mapping.

Table C-6. Fault Code Bit Definitions

BIT[A]	MASK	BIT LABEL	CONTROLLER	LASER
0	00000001	Base Plate Temp. Fault	Logical OR from all lasers	Base plate temperature out of range
1	00000002	Diode Temp. Fault	Logical OR from all lasers	Diode temperature out of range
2	00000004	Internal Temp. Fault	Logical OR from all lasers	Internal temperature out of range
3	00000008	Laser Power Supply Fault	Logical OR from all lasers	No electrical power to laser diode
4	00000010	I2C Error	Logical OR from all lasers	I2C bus error
5	00000020	Over Current	Logical OR from all lasers	Diode over current
6	00000040	Laser Checksum Error	Logical OR from all lasers	EEPROM checksum error in at least one section
7	00000080	Checksum Recovery	Logical OR from all lasers	EEPROM was restored to default settings
8	00000100	Buffer Overflow	Logical OR from all lasers	Bus message buffer overflow

Table C-6. Fault Code Bit Definitions (continued)

BIT[A]	MASK	BIT LABEL	CONTROLLER	LASER
9	00000200	Warm-up limit fault	Logical OR from all lasers	Warm-up time limit exceeded
10	00000400	TEC Driver Error	Logical OR from all lasers	TE controller driver failure
11	00000800	CCB Error	Logical OR from all lasers	RS-485 bus error
12	00001000	Diode Temp Limit Error	Logical OR from all lasers	Diode temperature off by > 5°C from set point
13	00002000	Laser Ready Fault	Logical OR from all lasers	Fail to emit at set power level
14	00004000	Photodiode Fault	Logical OR from all lasers	Negative photodiode readout
15	00008000	Fatal Fault	Logical OR from all lasers	Irrecoverable system failure
16	00010000	Startup Fault	Logical OR from all lasers	Errors encountered during firmware start-up
17	00020000	Watchdog Timer Reset	Logical OR from all lasers	Firmware resumed from watchdog reset
18	00040000	Field Calibration	Logical OR from all lasers	Errors encountered during field calibration
20	00100000	Over Power	Logical OR from all lasers	Output power above limit
...	...	...		
30	40000000	Controller Checksum	Controller checksum error	Always 0
31	80000000	Controller Status	Fault word is from controller	Always 0

a. Unspecified bits are reserved and are zero.

Turn On/Off Laser Status Indicator

Turns on (or turns off) the status indicator(s) associated with the laser. Setting is saved in persistent memory. The factory default is ON.

COMMAND	**`SYSTem:INDicator:LASer {ON|OFF}`**
QUERY	**`SYSTem:INDicator:LASer?`**
REPLY	**`ON|OFF`**

This command is used to turn on (or turn off) the Status LED indicator(s) that is visible to the user. The status bits returned by **`SYSTem:STATus?`**, however, are not affected by this command.

Error Record Reporting

Programming and system errors will occasionally occur while testing or debugging remote programs and during measurement. Error strings follow the SCPI Standard for error record definition:

`<error code>,<quoted error string><CR><LF>`

The host queries for errors in two steps.

1. First, the host queries for the number of error records available (N).
2. Secondly, the host queries N times for the error records.

Errors are stacked up to 20 deep. In the case of error overflow, the last error in the error list is an indication of error overflow.

Note that the error records defined in this section are the errors generated in response to external commands or queries. Any errors generated from the internal operation of the laser or controller will be reflected in the fault code displayed in Table C-6 (p. C-14).

Error Count Query

Gets the number of error records in the error queue at the time of the query.

COMMAND	None
QUERY	`SYSTem:ERRor:COUNt?`
REPLY	`<integer count of error records stored>`

Error Query

Gets the next error record(s) in the error queue.

- More than one error record may be queried using this optional parameter, which must be an integer value: **`<error record count>`**.
- A single error record is returned if **`<error record count>`** is not specified.

COMMAND	None
QUERY	`SYSTem:ERRor:NEXT?`
REPLY	`<next available error record>`

No reply is transmitted if there are no available error records.

As the device transmits each error record:

- The error record is permanently removed from the error queue.
- The queued error record count is decremented by one.

All Error Clear

Clears all error records in the error queue.

COMMAND	`SYSTem:ERRor:CLEar`
QUERY	None

Table C-7 lists possible error codes and briefly describes the text strings returned. Any errors generated from the internal operation of the lasers or controller are reflected in the fault code—see Table C-4 on page C-9.

Table C-7. Error Codes and Description Strings

ERROR CODE	ERROR STRING	ERROR DESCRIPTION
-400	Query Unavailable	Broadcast of query is prohibited. Occurs when sending a query as a broadcast message. Queries may not be broadcast.
-350	Queue overflow	Error queue is full. Non-**`Queue overflow`** errors are replaced by **`Queue overflow`** errors when there is exactly one available storage location available in the error queue. No additional errors are added to the error queue if the error queue is full.

Table C-7. Error Codes and Description Strings (continued)

Error Code	Error String	Error Description
-321	Out of memory	Internal memory is exhausted. Occurs when there is an internal memory related error. This error could be caused by exhaustion of the memory heap, overflow of a fixed memory buffer, or similar type of problem.
-310	System error	Unexpected/unrecoverable hardware or software fault. Occurs when the device firmware detects an unexpected or unrecoverable error. This error condition includes unrecoverable hardware faults.
-257	File to open not named	The file open is not possible because the file has not been named. Occurs when an attempt is made to open a file without specifying a file name.
-256	File does not exist	The specified file does not exist. Occurs when an attempt is made to open a file that does not exist.
-241	Device Unavailable	Command was sent to a device that is not available. Occurs when sending a message to a device that is not currently available.
-221	Settings conflict	Command not executed due to current device state. Occurs when a command is received that is at odds with the current device settings.
-220	Invalid parameter	The command or query parameter is invalid. Occurs when an invalid parameter has been specified.
-203	Command protected	Command is password protected. Occurs when an attempt is made to execute a password protected command when in user mode.
-200	Execution error	Command is out of order. Occurs when an order-dependent command sequence is issued out of order (for example, when trying to read from a file before the file has been opened).
-109	Parameter missing	No or fewer parameters were received. Occurs when there are no or fewer parameters for a received command or query.
-102	Syntax error	Unrecognized command or data type was encountered. Occurs when command or data type is not recognized.
-100	Unrecognized command or query	The command or query is not recognized. Occurs when the device receives an unrecognized command or query. This is a generic syntax error for devices that cannot detect more specific errors.
0	No error	No error.
500	CCB fault	A Coherent Connection bus error was encountered.
510	I2C bus fault	A device internal I2C bus error was encountered.
520	Controller Time Out	No response was received within 0.7 seconds from a slave device and the message was resent three (3) times by the controller.
900	CCB Message Timed Out	A A Coherent Connection bus message timed out after three 93) retries.

OBIS Common Commands and Queries

OBIS Common Commands and Queries is implemented by all OBIS devices that support the features contained in this section. If a device does not support a given feature, the command may be ignored.

System Information Queries

The System Information commands allow a host to retrieve static information describing the characteristics of the laser.

System Model Name Query

Retrieves the model name of the laser.

QUERY	**SYSTem:INFormation:MODel?**
REPLY	**<model name>**

System Manufacture Date Query

Retrieves the manufacture date of the device.

QUERY	**SYSTem:INFormation:MDATe?**
REPLY	**<manufacture date>**

System Calibration Date Query

Retrieves the calibration date of the device.

QUERY	**SYSTem:INFormation:CDATe?**
REPLY	**<calibration date>**

System Serial Number Query

Retrieves the serial number of the laser.

QUERY	SYSTem:INFormation:SNUMber?
REPLY	<serial number>

System Part Number Query

Retrieves the manufacturer part number of the laser.

QUERY	**SYSTem:INFormation:PNUMber?**
REPLY	**<manufacturer part number>**

System Firmware Version Query

Retrieves the current firmware version from the laser firmware. The format of the returned firmware version number string is identical to that described in the *IDN? Query.

QUERY	**SYSTem:INFormation:FVERsion?**
REPLY	**<current firmware version>**

System Protocol Version Query

Retrieves the current OBIS protocol version from the laser firmware.

QUERY	**`SYSTem:INFormation:PVERsion?`**
REPLY	**`<current protocol version>`**

The format of the returned firmware version number string is in the format:

```
P<major>.<minor><optional qualifier
characters>
```

For example, **`P1.0a`** is a valid firmware version format.

System Wavelength Query

Retrieves the actual wavelength (in nanometers) of the laser.

QUERY	**`SYSTem:INFormation:WAVelength?`**
REPLY	**`<wavelength>`**

System Power Rating Query

Retrieves the power rating (in watts) of the laser.

QUERY	**`SYSTem:INFormation:POWer?`**
REPLY	**`<power>`**

The power rating is minimum output power under a given set of operating conditions during the laser life. It is generally the same as nominal power

Device Type Query

Retrieves the device type. The device includes laser and controller. At this time, the types of lasers supported by this protocol are OBIS LX (Direct Diode), OBIS LS (OPSL) and OTHER. The set of extended laser-specific commands is determined by the response to this query. The type of the controller is hard coded in the controller.

QUERY	**`SYSTem:INFormation:TYPe?`**
REPLY	**`DDL|OPSL|MINI|MASTER|OTHER`**

CW Nominal Power Query

Returns the nominal CW laser output power in watts.

QUERY	**`SOURce:POWer:NOMinal?`**
REPLY	**`<x.xxxxx>`**

The reply string represents the nominal power value in watts.

CW Minimum Power Query

Returns the minimum CW laser output power in watts.

QUERY	**`SOURce:POWer:LIMit:LOW?`**
REPLY	**`<x.xxxxx>`**

The reply string represents the minimum power in watts.

CW Maximum Power Query

Returns the maximum CW laser output power in watts.

QUERY	**SOURce:POWer:LIMit:HIGH?**
REPLY	**<x.xxxxx>**

The reply string represents the maximum power value in watts.

Set/Query User-Defined ID

Enters and stores user-defined identification or any other information the user desires to store. The information is stored in nonvolatile memory.

COMMAND	**SYSTem:INFormation:USER <item number>, <item>**
QUERY	**SYSTem:INFormation:USER? <item number>**
REPLY	Item stored at the location pointed to by **<item number>**

The user can enter up to four items, with each comprised of up to 31 characters.The item number starts at zero.

Set/Query Field Calibration Date

Enters and stores the date on which the last field calibration was performed. This is normally done by the user or Coherent field service personnel.

COMMAND	**SYSTem:INFormation:FCDate <alphanumeric string>**
QUERY	**SYSTem:INFormation:FCDate?**
REPLY	**<alphanumeric string >**

Note: The number of alphanumeric character is limited to a maximum. of 31 characters.

System State Commands and Queries

System State commands allow a host to retrieve dynamic information describing the current operational state of the laser.

System Power Cycle Query

Returns the number of ON/OFF power cycles the laser has endured.

QUERY	**SYSTem:CYCLes?**
REPLY	**<integer cycle count>**

System Power Hour Query

Returns the number of hours the laser has been powered on.

QUERY	**SYSTem:HOURs?**
REPLY	**<value in x.xx format>**

Diode Hour Query

Returns the number of hours the laser diode has operated. This is defined as the accumulation of time while the “Laser Enable” pin is asserted.

QUERY	`SYSTem:DIODe:HOURs?`
REPLY	`<value in x.xx format>`

System Output Power Level Query

Returns the present output power of the laser measured in watts.

QUERY	`SOURce:POWer:LEVel?`
REPLY	`<x.xxxxx>`

The reply string is an NRf value representing the present laser output power measured in watts

System Output Current Query

Returns the present output current of the laser measured in amps.

QUERY	`SOURce:POWer:CURRent?`
REPLY	`<x.xxxxx>`

The reply string is an NRf value representing the present laser output current measured in amps.

Base Plate Temperature Query

Returns the present laser base plate temperature. An optional unit indicator may be specified. If the 'C' unit indicator is specified, or if the unit indicator is left off, the returned value represents the laser base plate temperature in degrees C. If the 'F' unit indicator is specified, the returned value represents the laser base temperature in degrees F.

QUERY	`SOURce:TEMPerature:BASeplate? {C|F}`
REPLY	<`x.xU` where U is the unit indicator '`C`' or '`F`'>

The reply string represents the base temperature in NRf format, with a unit indicator of 'C' or 'F' appended.

System Interlock Query

Returns the status of the system interlock. The method of determining interlock status is device dependent. This feature may not apply to the laser itself.

QUERY	`SYSTem:LOCK?`
REPLY	`ON|OFF`

Query returns the interlock state in string format.

Operational Commands and Queries

Operational commands and queries are used to configure and operate the laser from a Host or Controller. These commands and queries are for use by user level applications as well.

Laser Operating Mode Selection

Seven mutually exclusive operating modes are available:

- CWP (continuous wave, constant power)
- CWC (continuous wave, constant current)
- DIGITAL (CW with external digital modulation)
- ANALOG (CW with external analog modulation)
- MIXED (CW with external digital + analog modulation)
- DIGSO (External digital modulation with power feedback) Note: This operating mode is not supported in some device models.
- MIXSO (External mixed modulation with power feedback) Note: This operating mode is not supported in some device models.

The exact meaning of the selected mode is device-dependent.

Select CW Mode

Sets the laser operating mode to internal CW and deselects external modulation. The setting is saved in non-volatile memory.

The default setting is CW with constant power or CWP.

COMMAND	**SOURce:AM:INTernal CWP|CWC**

Select Modulation Mode

Sets the laser operating mode to CW constant current modulated by one or more external sources. MIXED source combines both external digital and external analog modulation. The setting is saved in non-volatile memory.

COMMAND	**SOURce:AM:EXTernal DIGital|ANALog|MIXed|DIGSO|MIXSO**

Laser Operating Mode Query

Queries the current operating mode of the laser.

QUERY	**SOURce:AM:SOURce?**
REPLY	**CWP|CWC|DIGITAL|ANALOG|MIXED|DIGSO|MIXSO**

The reply string represents the present laser operating mode, where CWP and CWC are not modulated externally and the other modes imply external modulation.

Set/Query Laser Power Level

Sets present laser power level in watts. Setting power level does not turn the laser on.

COMMAND	**SOURce:POWer:LEVel:IMMediate:AMPLitude <value**
QUERY	**SOURce:POWer:LEVel:IMMediate:AMPLitude?**
REPLY	**<x.xxxxx>**

The reply string represents the present laser power level setting as an NRf value in watts.

Set/Query Laser Enable

Turns the laser ON or OFF. When turning the laser ON, actual laser emission may be delayed due to internal circuit stabilization logic and/or CDRH delays.

COMMAND	**SOURce:AM:STATe ON|OFF**
QUERY	**SOURce:AM:STATe?**
REPLY	**ON|OFF**

Query returns the present laser ON/OFF state in string format.

Set/Query CDRH Delay

NOTICE!
Disabling the CDRH delay renders the OBIS system non-CDRH compliant.

Enables or disables the CDRH five-second laser emission delay.

COMMAND	**SYSTem:CDRH ON|OFF**
QUERY	**SYSTem:CDRH?**
REPLY	**ON|OFF**

Query returns the present CDRH setting in string format.

OBIS Optional Commands

This section describes the optional commands for OBIS lasers.

Set/Query TEC Enable

Enables or disables temperature control of the laser diode (OBIS LX) or resonator (OBIS LS) via the TEC circuit.

COMMAND	**SOURce:TEMPerature:APRobe ON|OFF**
QUERY	**SOURce:TEMPerature:APRobe?**
REPLY	**ON|OFF**

Query returns the present ON/OFF TEC control state in string format.

OBIS LX-Specific Commands

The commands in this section pertain to OBIS LX Direct Diode lasers (DDL) only.

Enable/Undo Laser Power Field Calibration

Starts a self laser power calibration using an internal reference. It is used to re-calibrate the laser power in the field against possible degradation of both laser diode and internal reference during its lifetime. You may undo the field calibration if need be.

COMMAND	**SOURce:POWer:CALibration**
COMMAND	**SOURce:POWer:UNCalibration**

The calibration process involved in this command may take a few minutes to finish. DO NOT disrupt the power supply until the process is complete. Status bit 11 is set up as a handshaking mechanism for the host program for the progress of calibration process.

Enable/Disable Blanking

Enables or disables Blanking in Analog Modulation mode.

COMMAND	**SOURce:AModulation:BLANKing ON|OFF**
QUERY	**SOURce:AModulation:BLANKing?**
REPLY	**Returns the present Analog Modulation Blanking-enabled state.**

Internal Temperature Limit Queries

These queries return the present internal temperature limit settings. An optional unit indicator may be specified. If the 'C' unit indicator is specified, or if the unit indicator is left off, the returned value represents the internal temperature high or low limit in degrees Celsius. If the 'F' unit indicator is specified, the returned value represents the internal temperature limit in degrees Fahrenheit. The internal temperature represents the temperature taken from a built-in temperature sensor of the microprocessor.

The reply string represents the limit value in NRf format with a unit indicator of 'C' or 'F' appended.

Internal Temperature High Limit Query

QUERY	**SOURce:TEMPerature:PROTection:INTernal:HIGH?**
REPLY	<**x.xU** where U is the unit indicator '**C**' or '**F**'>

Internal Temperature Low Limit Query

QUERY	**SOURce:TEMPerature:PROTection:INTernal:LOW?**
REPLY	<**x.xU** where U is the unit indicator '**C**' or '**F**'>

Diode Temperature Query

Returns the present laser diode temperature. An optional unit indicator may be specified. If the 'C' unit indicator is specified, or if the unit indicator is left off, the returned value represents the laser diode temperature in degrees C. If the 'F' unit indicator is specified, the returned value represents the laser diode temperature in degrees F.

QUERY	**SOURce:TEMPerature:DIODe? {C|F}**
REPLY	<**x.xU** where U is the unit indicator '**C**' or '**F**'>

The reply string represents the diode temperature in NRf format with a unit indicator of 'C' or 'F' appended.

Diode Set Point Temperature Query

Returns the diode set point temperature that the TEC controller manages to maintain. An optional unit indicator may be specified.

- If the 'C' unit indicator is specified, or if the unit indicator is left off, the returned value represents the laser diode temperature in degrees C.
- If the 'F' unit indicator is specified the returned value represents the laser diode temperature in degrees F.

QUERY	**SOURce:TEMPerature:DSETpoint? {C|F}**
REPLY	<**x.xU** where U is the unit indicator '**C**' or '**F**'>

The reply string represents the target temperature in NRf format with a unit indicator of 'C' or 'F' appended.

Internal Temperature Query

Returns the present internal laser temperature. An optional unit indicator may be specified.

- If the 'C' unit indicator is specified, or if the unit indicator is left off, the returned value represents the internal laser temperature in degrees C.
- If the 'F' unit indicator is specified the returned value represents the laser base temperature in degrees F.

QUERY	**SOURce:TEMPerature:INTernal? {C|F}**
REPLY	<**x.xU** where U is the unit indicator '**C**' or '**F**'>

The reply string represents the internal laser temperature in NRf format with a unit indicator of 'C' or 'F' appended.

Controls and Queries

The OBIS control and query command set confirms to the Standard Commands for Programmable Instruments (SCPI) and IEEE 488.2 standards. In short, a SCPI control command consists of a header built with keyword(s) plus one or more optional parameters. The header and the parameter(s) are separated by a space. A query command is formed by directly appending a question mark to the end of the header. For more detailed information on SCPI commands and syntax, refer to the SCPI standard documentation.

Following is a brief description of the notation conventions for OBIS commands:

- Parameter(s) following a control command is required.
- Item(s) within the angle brackets following a control or query command is required.
- Item(s) within the curly brackets following a control or query command is optional.
- Acceptable parameters or items required for a control or query command are separated by the OR symbol "|".
- The upper and lower bounds of the range for a parameter or item are given in parentheses.

Table C-8 lists the OBIS SCPI control commands for the OBIS Remote (MINI), the OBIS LX (DDL) laser, and the OBIS LS (OPSL) laser.

Table C-8. OBIS Control Commands

COMMAND	OBIS REMOTE (MINI)	OBIS LX (DDL)	OBIS LS (OPSL)	DESCRIPTION
*RST	X	X	X	Performs a firmware warm reset. Message handshaking, if enabled, is transmitted prior to the execution of reset. This command may be used to clear a fault condition.
SYSTem:COMMunicate:HANDshaking ON|OFF	X	X	X	Enables|Disables host/controller communication handshaking. This setting is stored in persistent memory so that it remains unchanged after a power ON/OFF cycle.
SYSTem:COMMunicate:PROMpt ON|OFF	X	X	X	Enables|Disables command/query prompt (>). This setting is stored in persistent memory.
SYSTem:AUTostart ON|OFF		X	X	Enables|Disables laser power automatic emission. Note: This setting is overridden by interlock switch, keyswitch, or other hardware mechanisms in the OBIS Remote. This setting is stored in persistent memory.
SYSTem:CDRH ON|OFF		X	X	Enables|Disables CDRH delay. This setting is stored in persistent memory.

Table C-8. OBIS Control Commands (continued)

COMMAND	OBIS REMOTE (MINI)	OBIS LX (DDL)	OBIS LS (OPSL)	DESCRIPTION
SYSTem:DIODe:WARMup ON|OFF		X		Enables|Disables laser diode warm-up process. • If this process is disabled, the laser is capable of starting emission as soon as the electronics is up and running. • If this process is enabled, the laser does not emit until after the warm-up process is complete, even if the laser-on command is issued or the Auto Start is enabled. This setting is stored in persistent memory.
SYSTem:RECovery		X	X	Recovers device from persistent checksum error. This command may also be used to restore device to factory default settings. The laser Status LED illumination, if enabled, displays steady green while the device is recovering. Persistent checksum error is an extremely rare event. Contact Coherent before using this command.
SYSTem:INFormation:AMODulation:TYPe 1|2	X			Selects electrical input impedance for the analog modulation channel of the OBIS Remote. Parameter 1 selects 50Ω while parameter 2 selects 2 kΩ. This setting is stored in persistent memory.
SYSTem:INDicator:LASer ON|OFF		X	X	Enables|Disables illumination of Status LED indicator. This setting does not affect the state of device status bits or fault bits. This setting is stored in persistent memory.
SYSTem:ERRor:CLEar	X	X	X	Clears host/controller communication error records.
SYSTem:INFormation:USER <index>, <item>	X	X	X	Enters and stores user-defined identification or other information. <index> = (0, 3). <item> = (0, 31 characters).
SOURce:AM:INTernal CWP|CWC		X	X	Sets laser internal operating mode. Note: The laser internal and external operating modes are mutually exclusive. CWP = CW constant power; CWC = CW constant current.
SOURce:AM:EXTernal DIGital|ANALog|MIXed|DIGSO|MIXSO		X	X	Sets laser external operating mode. Note: The laser internal and external operating modes are mutually exclusive and the laser is required to connect to a OBIS Remote to use these modes. DIGital = digital modulation with current feedback (Digital:Current); ANALog = analog modulation with power feedback (Analog:Power); MIXed = digital + analog modulation with current feedback (Mixed: Current); DIGSO = digital modulation with power feedback (Digital:Power); MIXSO = digital + analog modulation with power feedback (Mixed: Power).

Table C-8. OBIS Control Commands (continued)

COMMAND	OBIS REMOTE (MINI)	OBIS LX (DDL)	OBIS LS (OPSL)	DESCRIPTION
SOURce:POWer:LEVel:IMMediate:AMPLitude <laser_power>		X	X	Sets laser output power level in watts. <laser_power> = (0, 110% nominal power). This command itself will not enable laser emission. If laser emission has been enabled, this command will change the laser output power and the new setting is saved in persistent memory. Note: Setting power level to zero watts does not turn off the electrical power to the laser diode.
SOURce:AM:STATe ON|OFF		X	X	Turns laser emission ON or OFF. Actual laser emission may be delayed due to internal electronic circuit stabilization and/or CDRH delay.
SOURce:TEMPerature:APRobe ON|OFF		X	X	Enables|Disables thermoelectric cooler for DDL laser or thermal stabilization for OBIS LS (OPSL).
SOURce:POWer:CALibration		X		Performs field calibration for analog modulation. This command will result in a match of 5V analog input to 100% nominal power.
SOURce:AModulation:BLANKing ON|OFF	X	X		Enables|Disables Blanking in Analog:Power and `Mixed:current` operating mode.

Table C-9 lists the OBIS SCPI query commands for the OBIS Remote (MINI), the OBIS LX (DDL) laser, and the OBIS LS (OPSL) laser.

Table C-9. OBIS Query Commands

COMMAND	OBIS REMOTE (MINI)	OBIS LX (DDL)	OBIS LS (OPSL)	DESCRIPTION
*IDN?	X	X	X	Returns device identification string that includes information about manufacturer name, product name, nominal wavelength, power rating, the firmware version, and firmware release date in the format, as in this example: “Coherent, Inc - OBIS 405nm 50mW C - V1.0.1 - Dec 14 2010”.
*TST?	X	X	X	Returns 0xFFFFFFFF for DDL.
SYSTem:COMMunicate:HANDshaking?	X	X	X	Returns communication handshake setting. Reply = ON|OFF.
SYSTem:COMMunicate:PROMpt?	X	X	X	Returns command prompt setting. Reply = ON|OFF.
SYSTem:AUTostart?		X	X	Returns laser auto emission setting. Reply = ON|OFF.
SYSTem:CDRH?		X	X	Returns CDRH delay setting. Reply = ON|OFF.
SYSTem:FAULt?	X	X	X	Returns device fault bits in 32-bit hexadecimal format. Refer to Table C-6 (p. C-14) for definitions of device fault bits.

Table C-9. OBIS Query Commands (continued)

COMMAND	OBIS REMOTE (MINI)	OBIS LX (DDL)	OBIS LS (OPSL)	DESCRIPTION
SYSTem:CYCLes?		X	X	Returns number of device power-on cycles.
SYSTem:DIODe:HOUR?		X		Returns accumulated laser emission hours. The returned value has a resolution of two digits after decimal point.
SYSTem:DIODe:WARMup?		X		Returns diode warm-up setting. Reply = ON|OFF.
SYSTem:HOUR?		X	X	Returns accumulated device operating hours. The returned value has a resolution of two digits after decimal point.
SYSTem:LOCK?	X			Returns OBIS Remote interlock status. Reply = ON|OFF, with ON = Close and OFF = Open.
SYSTem:INFormation:AMODulation:TYPe?	X			Returns input impedance type for OBIS Remote analog modulation channel. Reply = 1|2, with 1 = 50 Ω and 2 = 2 kΩ.
SYSTem:NOISe?		X		Returns noise level of laser power. The returned integer is a relative measure of laser power stability. It applies to constant power mode only. A level above 30 is considered noisy. It is normal to see a relatively high noise level when the laser is warming up or when the laser power is changed.
SYSTem:INDicator:LASer?		X	X	Returns LED status indicator setting. Reply = ON|OFF.
SYSTem:ERRor:COUNt?	X	X	X	Returns host/controller communication error count.
SYSTem:ERRor:NEXT?	X	X	X	Returns host/controller communication error record.
SYSTem:INFormation:MODel?	X	X	X	Returns device model.
SYSTem:INFormation:MDATe?	X	X	X	Returns device manufacture date.
SYSTem:INFormation:CDATe?	X	X	X	Returns device calibration date.
SYSTem:INFormation:SNUMber?	X	X	X	Returns device serial number.
SYSTem:INFormation:PNUMber?	X	X	X	Returns device manufacturer part number.
SYSTem:INFormation:FVERsion?	X	X	X	Returns device firmware version.
SYSTem:INFormation:WAVelength?		X	X	Returns laser nominal wavelength in nanometers based on a diode operating temperature of 25 degrees Celsius.
SYSTem:INFormation:POWer?		X	X	Returns laser power rating in watts.
SYSTem:INFormation:TYPe?	X	X	X	Returns device type. Reply = MINI|DDL|OPSL.

Table C-9. OBIS Query Commands (continued)

<table>
<tr><th>COMMAND</th><th>OBIS REMOTE (MINI)</th><th>OBIS LX (DDL)</th><th>OBIS LS (OPSL)</th><th>DESCRIPTION</th></tr>
<tr><td>SOURce:POWer:LIMit:LOW?</td><td></td><td>X</td><td>X</td><td>Returns minimum laser power output in watts available in CW constant current or CW constant power mode.</td></tr>
<tr><td>SOURce:POWer:LIMit:HIGH?</td><td></td><td>X</td><td>X</td><td>Returns maximum laser power output in watts available in CW constant current or CW constant power mode.</td></tr>
<tr><td>SYSTem:INFormation:USER? <index></td><td>X</td><td>X</td><td>X</td><td>Returns user defined identification. <index> = (0,3).</td></tr>
<tr><td>SOURce:POWer:LEVel?</td><td></td><td>X</td><td>X</td><td>Returns present laser output power in watts.</td></tr>
<tr><td>SOURce:POWer:CURRent?</td><td></td><td>X</td><td>X</td><td>Returns present laser output current in amperes.</td></tr>
<tr><td>SOURce:TEMPerature:BASeplate? {C|F}</td><td></td><td>X</td><td>X</td><td>Returns present baseplate temperature.</td></tr>
<tr><td>SOURce:AM:SOURce?</td><td></td><td>X</td><td>X</td><td>Returns present laser operating mode. Reply = CWP|CWC|DIGITAL|ANALOG|MIXED|DIGSO|MIXSO.</td></tr>
<tr><td>SOURce:POWer:LEVel:IMMediate:AMPLitude?</td><td></td><td>X</td><td>X</td><td>Returns laser output power set level in watts.</td></tr>
<tr><td>SOURce:AM:STATe?</td><td></td><td>X</td><td>X</td><td>Returns laser emission status. Reply = ON|OFF.</td></tr>
<tr><td>SOURce:TEMPerature:PROTection:BASeplate:HIGH? {C|F}</td><td></td><td>X</td><td>X</td><td>Returns maximum laser baseplate temperature without triggering a fault condition.</td></tr>
<tr><td>SOURce:TEMPerature:PROTection:BASeplate:LOW? {C|F}</td><td></td><td>X</td><td>X</td><td>Returns minimum laser baseplate temperature without triggering a fault condition.</td></tr>
<tr><td>SOURce:AModulation:BLANKing?</td><td>X</td><td>X</td><td></td><td>Returns the present ON|OFF Blanking-enabled state.</td></tr>
<tr><td>SOURce:TEMPerature:PROTection:DIODe:HIGH? {C|F}</td><td></td><td>X</td><td></td><td>Returns maximum laser diode temperature without triggering a fault condition.</td></tr>
<tr><td>SOURce:TEMPerature:PROTection:DIODe:LOW? {C|F}</td><td></td><td>X</td><td></td><td>Returns minimum laser diode temperature without triggering a fault condition.</td></tr>
<tr><td>SOURce:TEMPerature:DIODe? {C|F}</td><td></td><td>X</td><td></td><td>Returns present laser diode temperature.</td></tr>
<tr><td>SOURce:TEMPerature:DIODe:DSETpoint? {C|F}</td><td></td><td>X</td><td></td><td>Returns TEC temperature set point for the laser diode.</td></tr>
<tr><td>SOURce:TEMPerature:APRobe?</td><td></td><td>X</td><td></td><td>Returns thermoelectric cooler (TEC) status. Reply = ON|OFF.</td></tr>
<tr><td>SOURce:CURRent:LIMit:LOW?</td><td></td><td>X</td><td>X</td><td>Returns laser diode threshold current in amperes.</td></tr>
<tr><td>SOURce:CURRent:LIMit:HIGH?</td><td></td><td>X</td><td></td><td>Returns laser diode upper current level in amperes. Note: Only valid with OBIS LX lasers with firmware 2.x or later.</td></tr>
</table>

Table C-10 lists the status code bit definitions.

Table C-10. Status Code Bit Definitions

BIT CODE	MASK VALUE	BIT LABEL	DESCRIPTION	
			OBIS REMOTE	LASER
0	00000001	Laser Fault	Logical OR from laser	Laser fault
1	00000002	Laser Emission	Logical OR from laser	Laser emission status
2	00000004	Laser Ready	Logical OR from laser	Laser ready status
3	00000008	Laser Standby	Logical OR from laser	Laser standby status
4	00000010	CDRH Delay	Logical OR from laser	Laser CDRH delay status
5	00000020	Laser Hardware Fault	Logical OR from laser	Hardware related fault
6	00000040	Laser Error	Logical OR from laser	Laser error is queued
7	00000080	Laser Power Calibration	Logical OR from laser	Laser power is within factory calibration specification
8	00000100	Laser Warm Up	Logical OR from laser	Laser warm-up status
9	00000200	Laser Noise	Logical OR from laser	Noise level is over 30
10	00000400	External Operating Mode	Logical OR from laser	External operating mode is selected
...	...	...		
25	02000000	Controller Standby	Keyswitch is in “STANDBY” position	Always 0
26	04000000	Controller Interlock	“INTERLOCK” is open	Always 0
27	08000000	Controller Enumeration	Laser has been enumerated	Always 0
28	10000000	Controller Error	OBIS Remote error flag	Always 0
29	20000000	Controller Fault	OBIS Remote fault status	Always 0
30	40000000	Remote Active	A remote host is connected	Always 0
31	80000000	Controller Indicator	Status word is from OBIS Remote	Always 0

System Standby and Sleep Mode

For users requiring intermittent use of the OBIS Laser System, two levels of non-lasing conditions are available:

- "Standby" represents the thermoelectric cooler (TEC), maintaining constant diode temperature with the laser diode off.
- "Sleep Mode" represents that both TEC and the laser are off.

With factory default settings, the OBIS Laser is in the "Standby" condition after the system is turned on and the warm-up procedure is complete.

To start the "Sleep Mode" condition, use this command to turn off the TEC in the laser:

```
SOURce:TEMPerature:ARPobe OFF
```

To return to the "Standby" condition, use this command to switch on the TEC and wait for the warm-up procedure to complete:

```
SOURce:TEMPerature:ARPobe ON
```

The "Sleep Mode" is only possible for the OBIS LX (Direct Diode) system and is not available for the OBIS LS (OPSL) system.

OBIS RS-232 Interface

Table C-11 lists the pin connections for the RS-232 connector:

Table C-11. 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)		

Table C-12 lists the communication settings for the RS-232 connector:

Table C-12. RS-232 Communication Settings

SETTING	VALUE
Baud	115200
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Table C-13 lists the factory default settings:

Table C-13. Factory Default Settings

SETTING	DESCRIPTION
OFF	Command prompt
ON	Command handshake
ON	Laser emission Auto Start
ON	CDRH delay
ON	Laser warm-up
Nominal power	Output power level
0 watts	Minimum power output limit
110% nominal power	Maximum power output limit
CW constant power (CWP)	Operating mode
25°C	Laser diode set temperature[a]
ON	Laser Status LED
ON	Laser thermoelectric cooler[b]
50Ω	OBIS Remote analog input impedance
Degrees Celsius	Unit for all temperature settings

a. LX version only
b. LX system only

APPENDIX D: BACK REFLECTION

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

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

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.

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

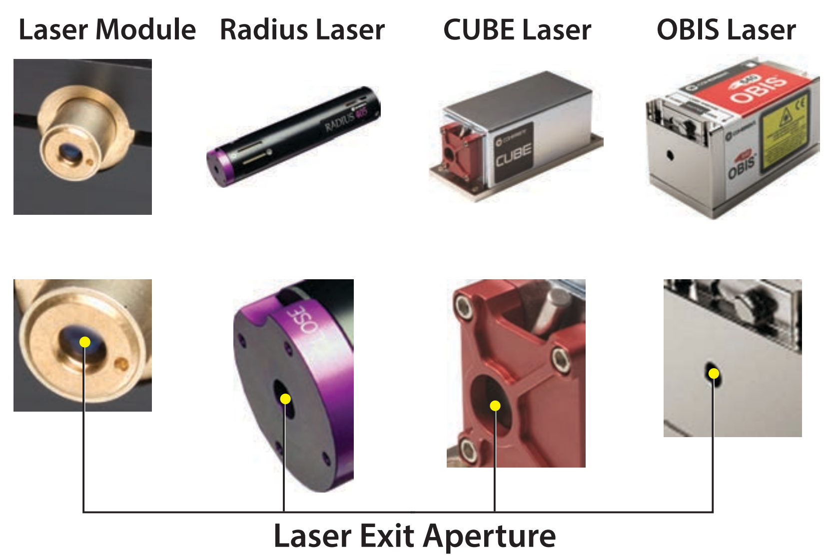


Figure D-1. Location of Exit Apertures

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

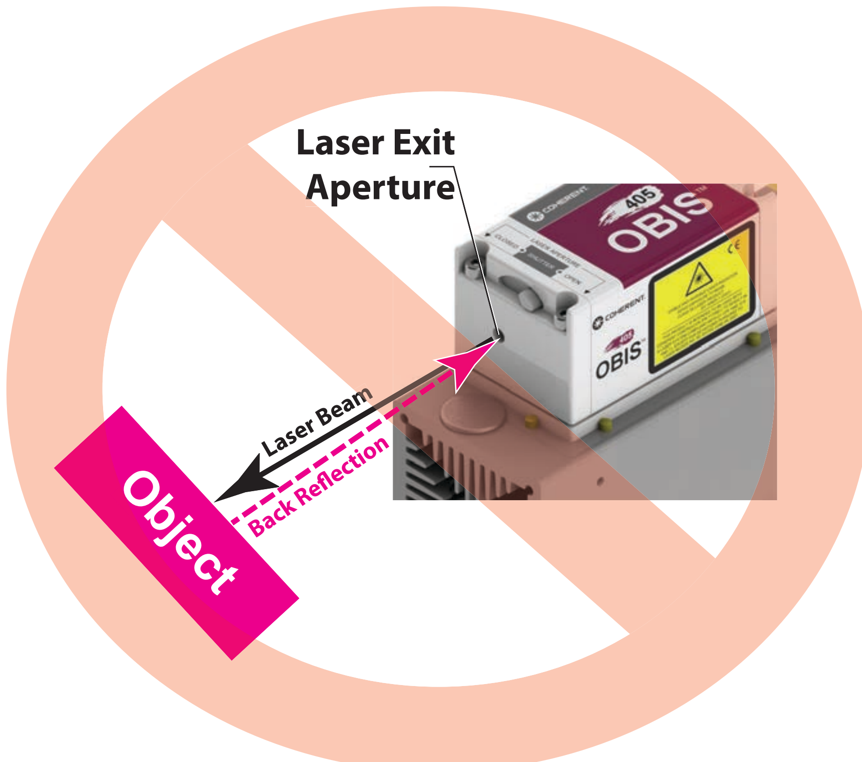


Figure D-2. Laser Back Reflection

NOTICE!
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 D-3.

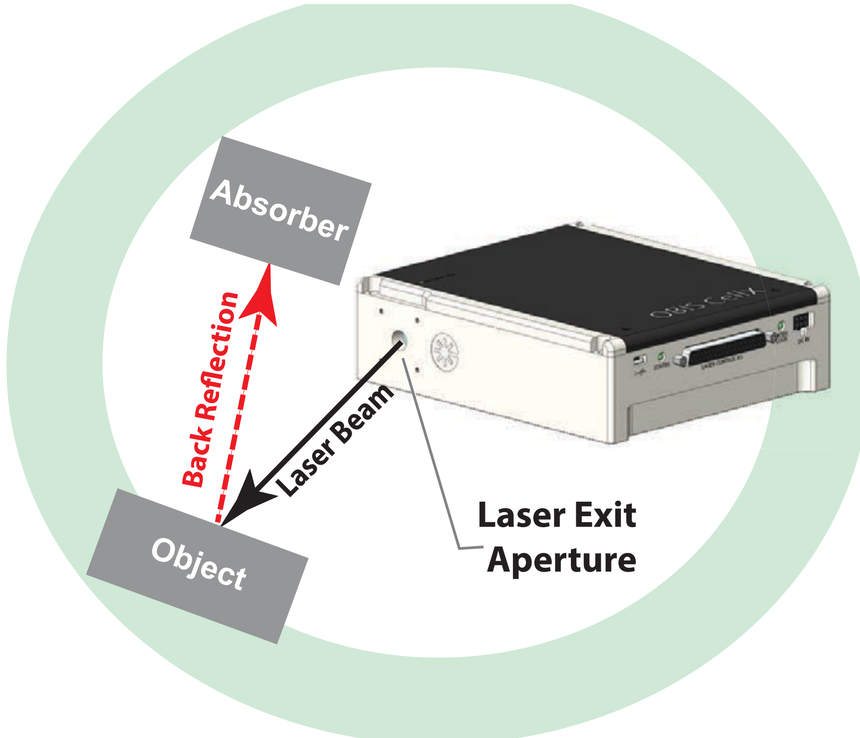


Figure D-3. Reflect Laser Light Away from Laser Exit Aperture

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.
- 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 D-4 shows a set-up that might cause back reflection damage.

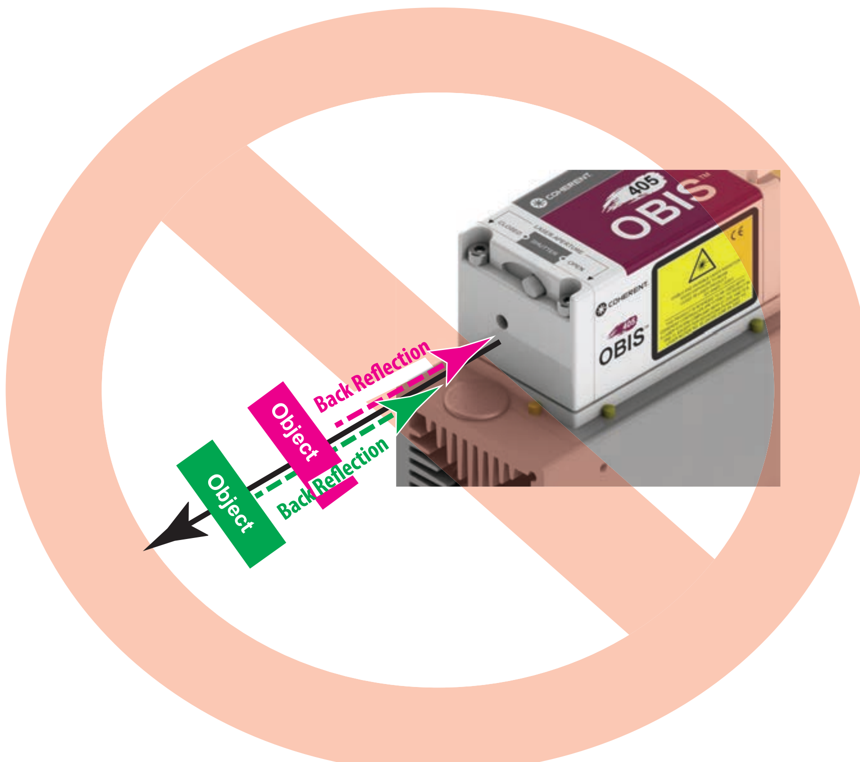


Figure D-4. Incorrect Set-Up Causes Laser Back Reflection Damage

The set-up shown in Figure D-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.

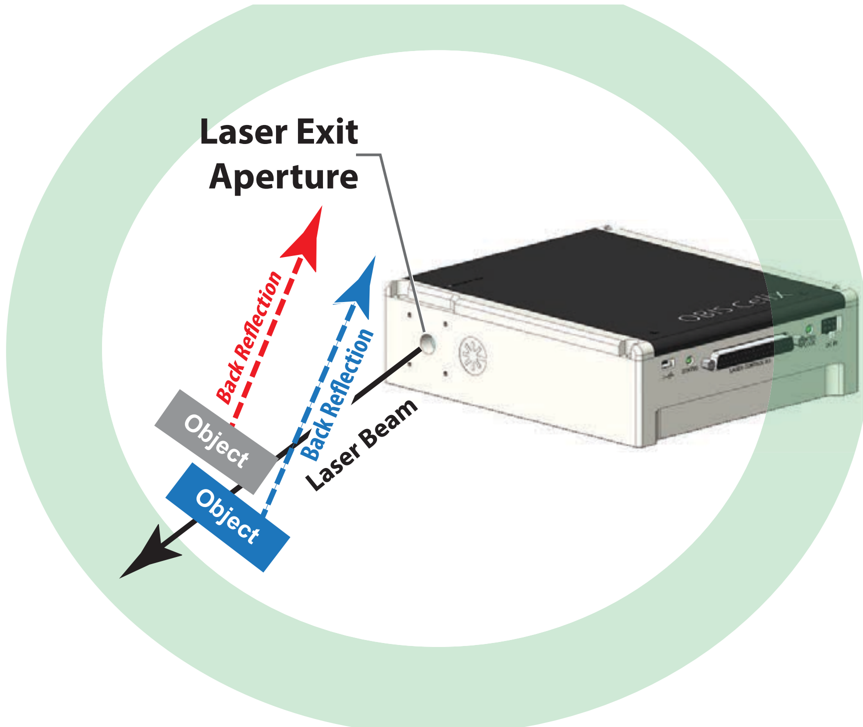


Figure D-5. Safer Laser Set-Up

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.

- 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.

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.

APPENDIX E: OBIS SDR BREAKOUT BOARD

The SDR Breakout Board is designed to speed up the development and bring-up cycles for our customers. The Board provides access to all the signals on the OBIS SDR connector and allows the user to connect to the Board through either a standard 40-pin ribbon cable connection, or through SMB connections. The Board also provides an area to prototype desired custom circuitry.

Features

Figure E-1 shows the features of the SDR Breakout Board:

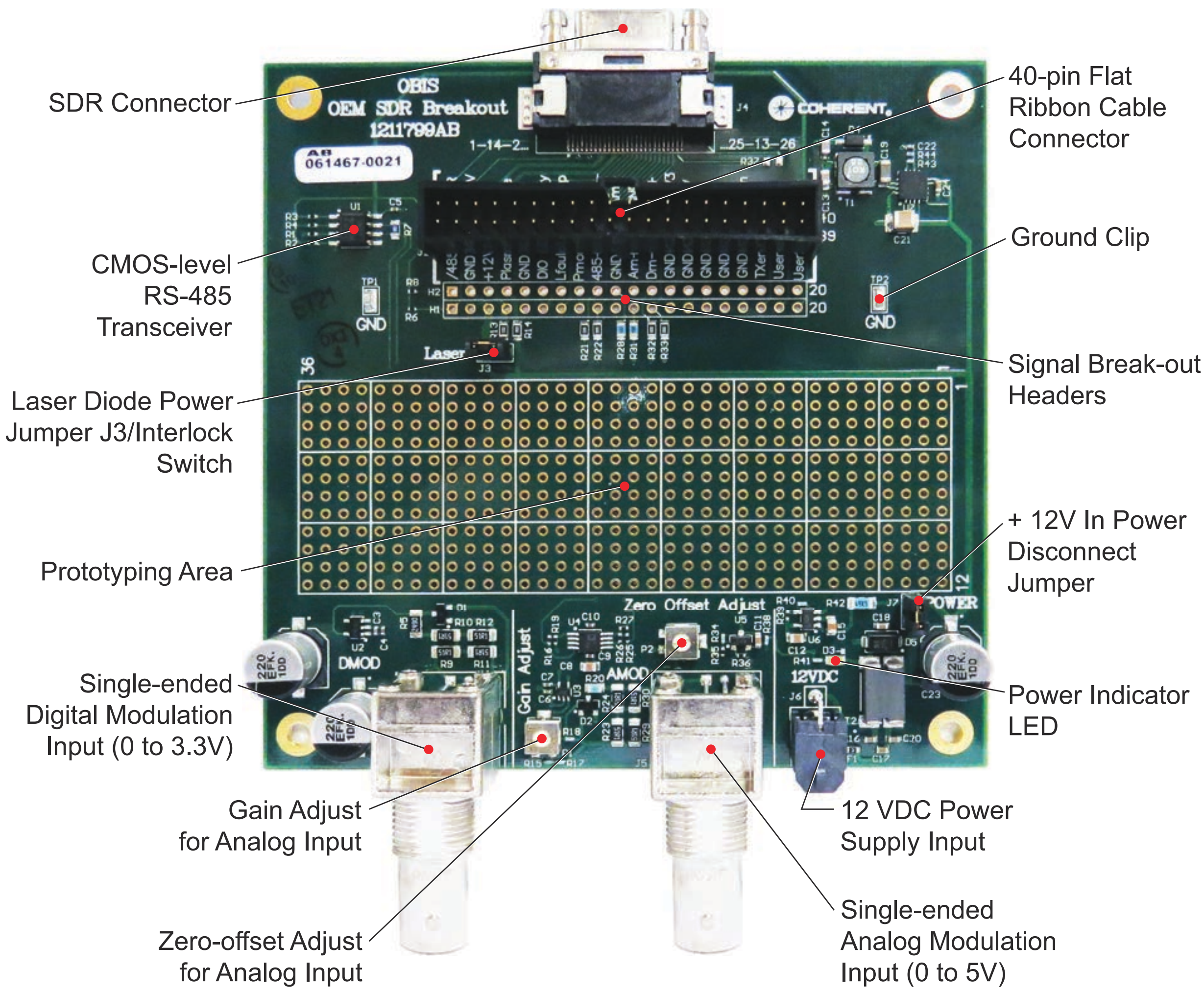


Figure E-1. OBIS SDR Breakout Board

SDR Breakout Board features include:

- 12 VDC power input using standard OBIS power supply
- Single-ended 50 ohm 0 to 5V analog modulation input through a BNC connector
- Single-ended 50 ohm 0 to 0.3V digital modulation input through a BNC connector
- Adjustable potentiometer for the zero-offset voltage of the analog modulation input
- Adjustable potentiometer for the gain of the analog modulation input
- All SDR cable signals broken out on a 2x20, 40-pin ribbon cable connector
- Additional 40-pin break-out headers for direct and individual signal access
- RS-485 bus converted to 3.3V CMOS logic levels
- 100-mil grid prototyping area for custom circuitry
- Power disconnect jumper to turn off power to OBIS
- Power Indicator LED
- Interlock jumper to control laser emission
- + 3.3V @ 400 mA and - 3V @ 200 mA available for customer use

This Board contains all the functional blocks needed to drive an OBIS Laser at full analog and digital modulation bandwidth. Customers can very quickly observe their operation and modify or adapt them to their own needs by adding their own circuitry in the 100-mil grid through-hole.

Functional Guide

This section describes the various functions of the SDR Breakout Board.

Power

Power to the SDR Breakout Board and OBIS Laser is supplied through J6 (12 VDC), and can be controlled with jumper J7. Insertion of the jumper provides power to the Breakout Board and OBIS Laser; extraction of the jumper turns all power off.

Interlock

Jumper J3 provides power to the laser diode in the OBIS Laser and acts as an interlock. Removal of the jumper will turn off laser emission; insertion of the jumper will turn the laser back on.

Digital Modulation

The SDR Breakout Board has a single-ended BNC input (J1) for digital modulation (0 to 3.3V). The circuit on the Board converts the signal into the differential LVDS signal used by the OBIS Laser.

To disable the single-ended digital modulation input and use the differential LVDS inputs accessible from the flat ribbon cable connector or breakout header, remove R32 and R33 (0 ohm).

Analog Modulation

The SDR Breakout Board has a single-ended BNC input (J5) for analog modulation (0 to 5V). The circuit on the Board converts the signal into the differential signal (-0.93V to 0.93V) used by the OBIS Laser. To disable the single-ended analog modulation input and use the differential inputs accessible from the flat ribbon cable connector or breakout header, remove R28 and R31 (0 ohm).

Analog Modulation Zero-Offset Adjustment

The zero-offset voltage of the analog modulation signal can be adjusted by rotating the potentiometer P2 on the Board. Adjustment of the zero-offset voltage will increase or decrease the amount of current supplied to the laser diode when the laser is driven with a 0V input. A higher zero-offset voltage will allow for a shorter turn-on delay.

Analog Modulation Gain Adjustment

Similarly, the gain of the analog modulation amplifier can be adjusted by rotating the potentiometer P1 on the Board. Adjusting the gain will increase or decrease the maximum laser output power at the maximum analog input voltage (5V).

RS-485 to 3.3V CMOS Converter

The SDR Breakout Board houses a differential RS-485 to single-ended 3.3V CMOS transceiver for development convenience. The CMOS signals can be accessed through the flat ribbon cable connector J2 or through the breakout headers H1 and H2.

3.3V and -3V Supplies

3.3V @ 400 mA and - 3V @ 200mA are available through the flat ribbon cable connector J2 and through the breakout headers H1 and H2.

Prototyping Area

The prototyping area is a 0.1 inch through-hole grid for the user's convenience.

Ribbon Cable Connector and Breakout Header

The ribbon cable breakout headers provide local access to all the SDR signals and some additional signals. Table E-1 describes the pin-outs.

Table E-1. Ribbon Cable Connector Pin-outs

PIN NUMBER HEADERS H1, H2	PIN NUMBER CONNECTOR J2	PIN NAME	PIN DESCRIPTION
H1-1	J2-1	RS485_INHIBIT	Pulled high in laser. Must be pulled low to enable RS-485 communication. Refer to "Appendix F: OBIS RS-485 Interface" (p. F-1).
H1-2	J2-2	GND	Ground
H1-3	J2-3	+12 Vin	12 VDC supply to the Breakout Board and to Plaser and Phouse. Can be powered off by removing J7.
H1-4	J2-4	Plaser	12 VDC supply to the laser diode. Also used as interlock. It can be powered down by removing J3 and it can be isolated from + 12 Vin by removing R15.
H1-5	J2-5	GND	Ground
H1-6	J2-6	DIO_CURR	Analog output. 0 to 2V = 0A - maximum allowed diode current.
H1-7	J2-7	LASER_FAULT	< 0.5V: laser OK > 2.5V laser shows error
H1-8	J2-8	PWRMON	Analog output driven by the photodiode amplifier. Scaled to 0 to 2V = 0 to 100% power.
H1-9	J2-9	RS485_P	Differential serial bus high side
H1-10	J2-10	GND	Ground
H1-11	J2-11	AMOD_P	Positive line for analog power modulation. 0 to 4V common mode. - 0.930 to + 0.930V differential scales to 0 to 110% output power.
H1-12	J2-12	DMOD_N	Differential digital modulation input low side. LVDS signal level.
H1-13	J2-13	GND	Ground
H1-14	J2-14	GND	Ground
H1-15	J2-15	GND	Ground
H1-16	J2-16	GND	Ground
H1-17	J2-17	GND	Ground
H1-18	J2-18	TXen	Enables the 3.3V CMOS version of RS-485 transmit signal. Active high to enable.
H1-19	J2-19	User1	Spare signal for the user. Not connected to the SDR connector.
H1-20	J2-20	User2	Spare signal for the user. Not connected to the SDR connector.
H2-1	J2-21	SDR_IN_USE#	Pulled high in the laser. This signal is looped back to pin 13 in the remote so a low on this pin signals to the laser the presence of a host.
H2-2	J2-22	+ 12 Vin	12 VDC supply to the Breakout Board and to Plaser and Phouse.
H2-3	J2-23	GND	Ground
H2-4	J2-24	Phouse	12 VDC supply to the OBIS Laser. It can be powered down by removing J7 and it can be isolated from + 12 Vin by removing R17.

Table E-1. Ribbon Cable Connector Pin-outs (continued)

PIN NUMBER HEADERS H1, H2	PIN NUMBER CONNECTOR J2	PIN NAME	PIN DESCRIPTION
H2-5	J2-25	NC	No connect
H2-6	J2-26	LASER_READY	> 2.5V when laser output active (only CW mode) and output power is within ± 2% set power; otherwise < 0.5V.
H2-7	J2-27	BP_TEMP	<0.5V: baseplate temp below (upper limit - 10°C). 1.2 to 2V: baseplate between (upper limit - 10°C) and upper limit. > 2.7V: baseplate above upper limit.
H2-8	J2-28	GND	Ground
H2-9	J2-29	RS485_N	Differential serial bus low side.
H2-10	J2-30	AMOD_N	Negative line for analog power modulation. 0 to 4V common mode. - 0.930 to + 0.930V differential scales to 0 to 110% output power.
H2-11	J2-31	GND	Ground
H2-12	J2-32	DMOD_P	Differential digital modulation input high side. LVDS signal level.
H2-13	J2-33	+ 3.3V	+ 3.3V at 400 mA output generated on the Breakout Board to power custom circuitry on the prototyping grid.
H2-14	J2-34	- 3V	- 3V at 200 mA output generated on the Breakout Board to power custom circuitry on the prototyping grid.
H2-15	J2-35	TX	3.3V CMOS version of the RS-485 transmit signal.
H2-16	J2-36	RX	3.3V CMOS version of the RS-485 receive signal.
H2-17	J2-37	RXen#	Enables the 3.3V CMOS version of RS-485 receive signal. Active low to enable.
H2-18	J2-38	GND	Ground
H2-19	J2-39	GND	Ground
H2-20	J2-40	GND	Ground

Schematics

The following figures present schematics for the SDR Breakout Board.

Figure E-2 illustrates Fast Digital Modulation, with input protected to intermittent application of +/- 12 volts.

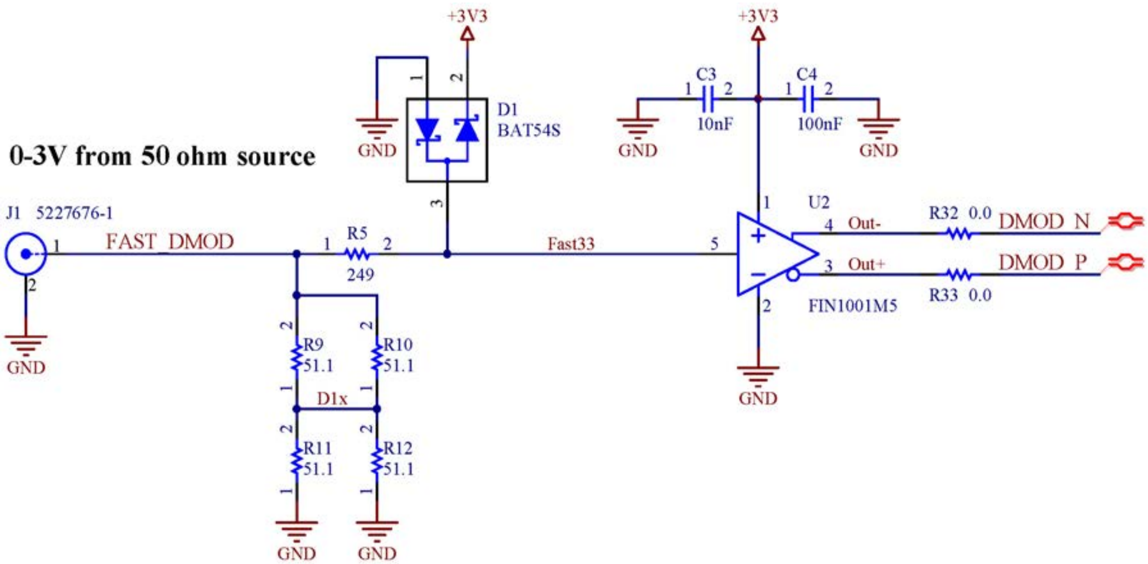


Figure E-2. SDR Schematic — 1

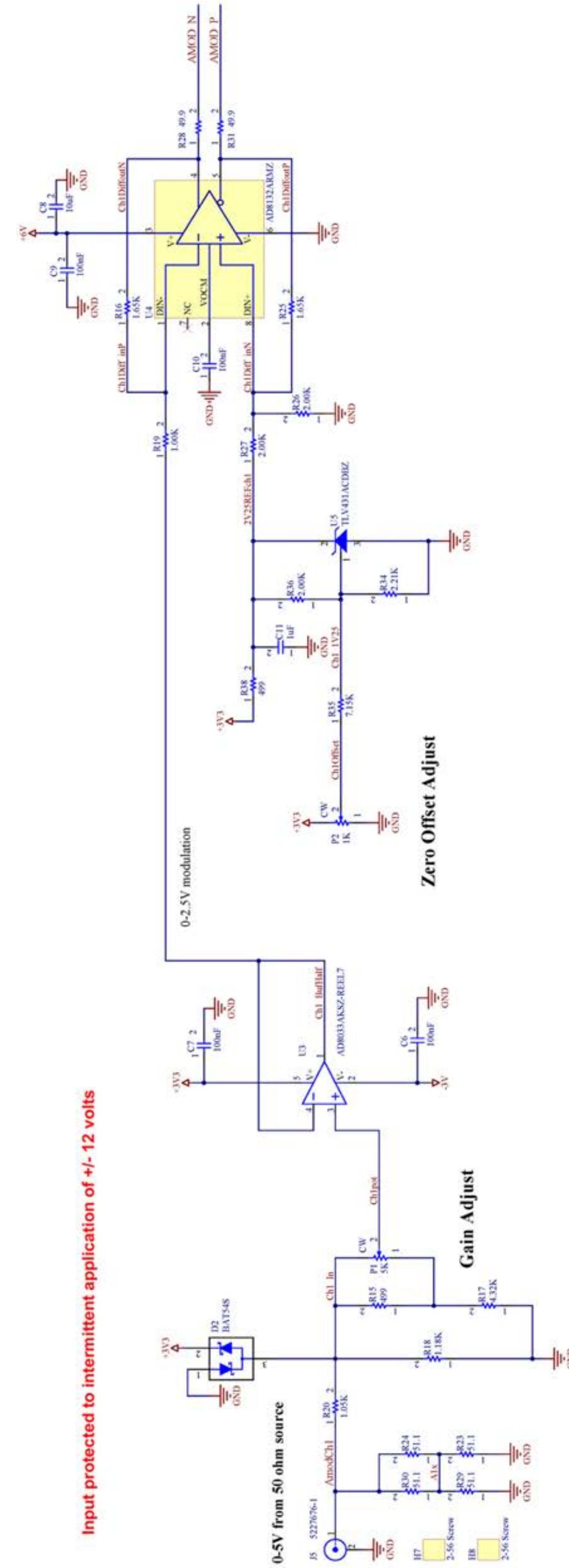


Figure E-3. SDR Schematic — 2

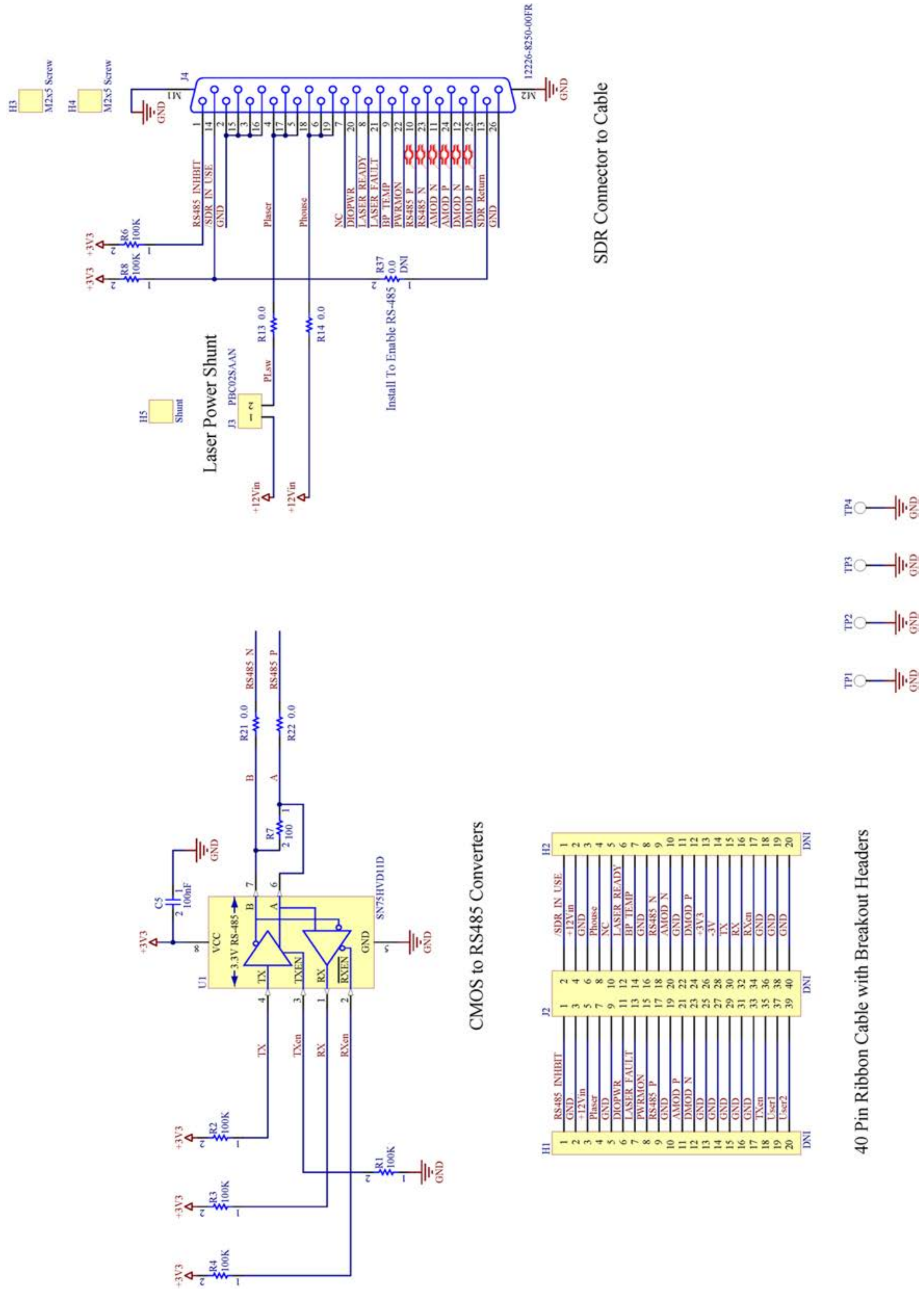


Figure E-4. SDR Schematic — 3

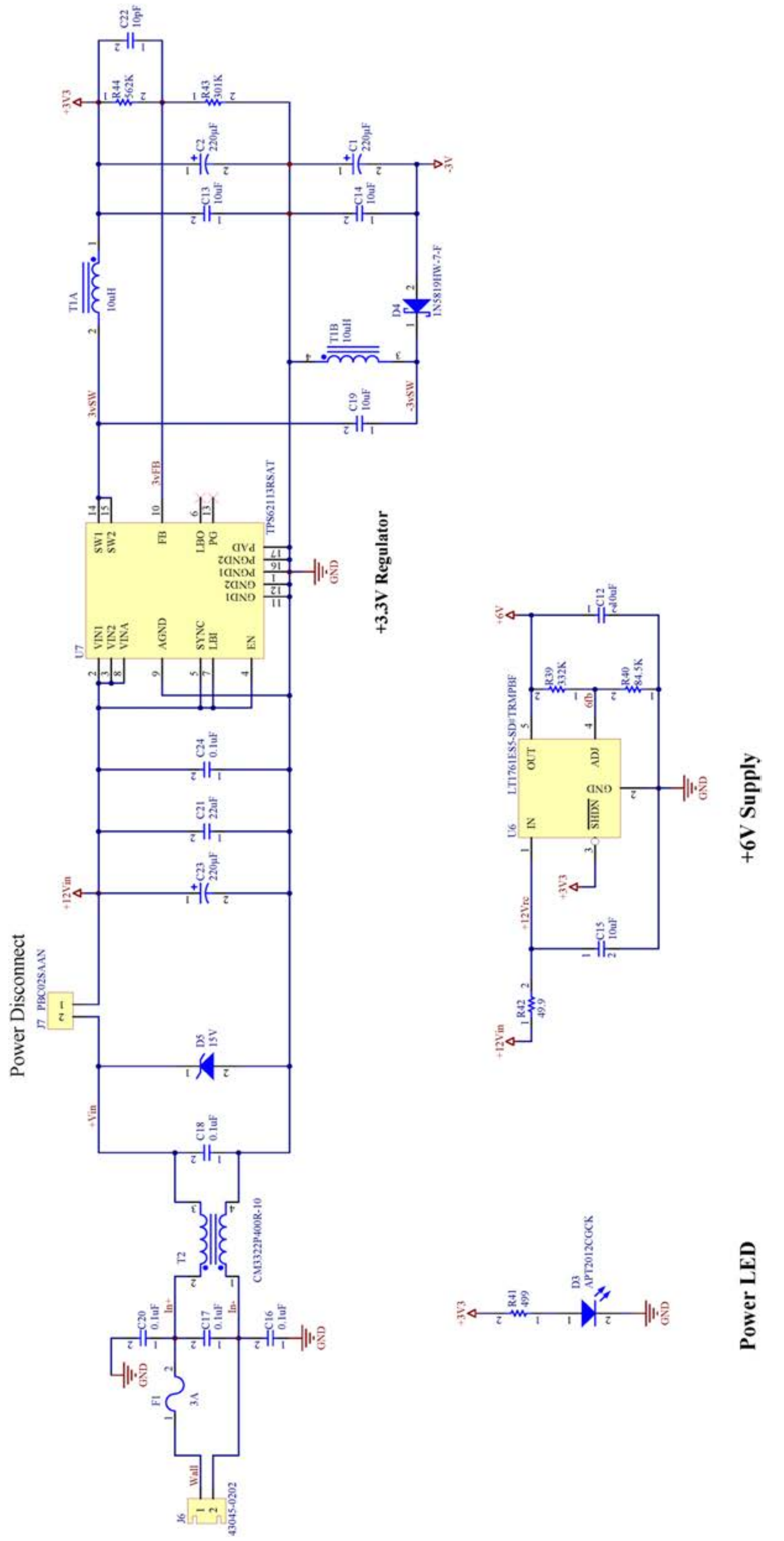


Figure E-5. SDR Schematic — 4

Analog Modulation LVDS Voltage Adjustment

Adjustment of the Gain and Offset is required when operating in Analog modulation mode using the AMOD input (BNC, J5).

Figure E-6 shows the various pins.

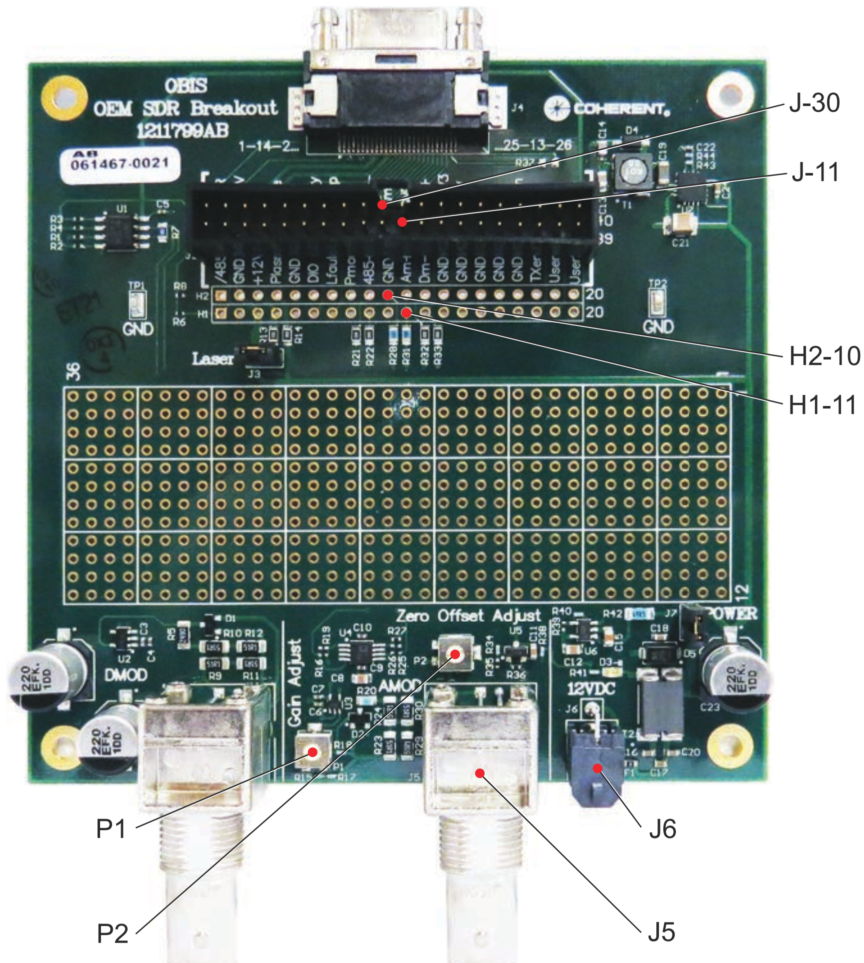


Figure E-6. Pins for Adjusting Analog Modulation

Adjustment Procedure

To adjust analog modulation:

1. Use a Coherent OBIS SDR cable to connect the OBIS Laser to the SDR Breakout Board.
2. Connect 12 VDC power to J6.
3. Connect a variable input voltage source (0 to 5.0V) to the single-ended Analog Modulation Input BNC connector (J5).
4. Connect a USB cable between the back panel of the OBIS Laser and a host computer to change the operating mode of the OBIS Laser. Use either Coherent Connection applications software 3.0.x or send host commands and queries to communicate between the OBIS Laser and the host computer.
5. Switch the operating mode from CW to Analog Modulation.

6. Start the OBIS Laser by turning the laser ON and applying 4.55 VDC to the Analog Modulation input.
7. Using a voltage meter, measure the voltage between VMOD+ (Positive) and VMOD- (Negative) to confirm a **LVDS Voltage of 0.760V**. The measurement can be taken between pins H1-11 (AMOD+) and H2-10 (AMOD-), or between pins J-11 (AMOD+) and J-30 (AMOD-) on connector J2. See Table E-1 (p. E-3) for details about pin-outs.
   - If the LVDS voltage is not set at 0.760V with an analog input voltage level of 4.55 VDC, adjust the setting by turning the Gain Adjust potentiometer (P1) to obtain a LVDS voltage of 0.760V.
   - Increase the analog modulation input voltage to 5.0V and confirm the measured LVDS voltage of the OBIS Laser is 0.930V.
8. Decrease the analog modulation input voltage level to 0.0V and confirm the measured LVDS voltage between AMOD+ and AMOD- is -0.930V.

   If the LVDS voltage is not set at -0.930V, adjust the Zero Offset Adjustment potentiometer (P2) to obtain a LVDS voltage level of -0.930V. Table E-2 lists input voltage levels.

Table E-2. OBIS Modulation Input Voltage Levels

Description	**Explanation**	**Voltage at the 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 Applicable
Analog Modulation Minimum Power	Minimum Power	0.0V	-0.930V	0 mW with Blanking Enabled	< 1 mW

9. Using either Coherent Connection software or host commands, switch the operating mode from CW to Analog Modulation.
10. Return the input voltage to 4.55 VDC and confirm that the LVDS voltage is at 0.760V—the nominal output power of an OBIS Laser.
11. Confirm the OBIS Laser output level using an external power measurement instrument, Coherent Connection software, or a host interface query through a terminal program.

APPENDIX F: OBIS RS-485 INTERFACE

This appendix describes the recommended RS-485 serial communication interface between a host micro-controller and several OBIS lasers, with the primary focus on the hardware configuration.

In this section:

Introduction

The communication protocol used by OBIS lasers was designed with reliability and simplicity as the driving factors. While the RS-485 hardware layer supports multi-drop, the communication protocol used by OBIS lasers does not.

A host that wants to control more than one laser must either use one UART (Universal Asynchronous Receiver/Transmitter) for each channel, or multiplex a single UART.

This section describes a simple implementation of a two-channel multiplexer driven by a single UART port on the host micro-controller. The information only describes the serial interface on the SDR port of the host. For information about all of the other signals on the SDR port, refer to Table 7-2 on page 7-4.

Design Description

Table F-1 lists the signals transmitted to and from the processor.

Table F-1. Signals to and from the Processor

SIGNALS TO THE PROCESSOR	SIGNALS FROM THE PROCESSOR
OBIS-RX	OBIS-TX
/SDR_IN_USE1	TXen1
/SDR_IN_USE2	TXen2 RXen1 RXen2

The schematic presented in Figure F-1 on page F-2 shows the implementation of the required interface to two OBIS lasers. To interface a larger number of lasers, the circuits must be replicated. Note that R7 and R8 serve only to guard against bus fighting when more than one TXen line is asserted at the same time.

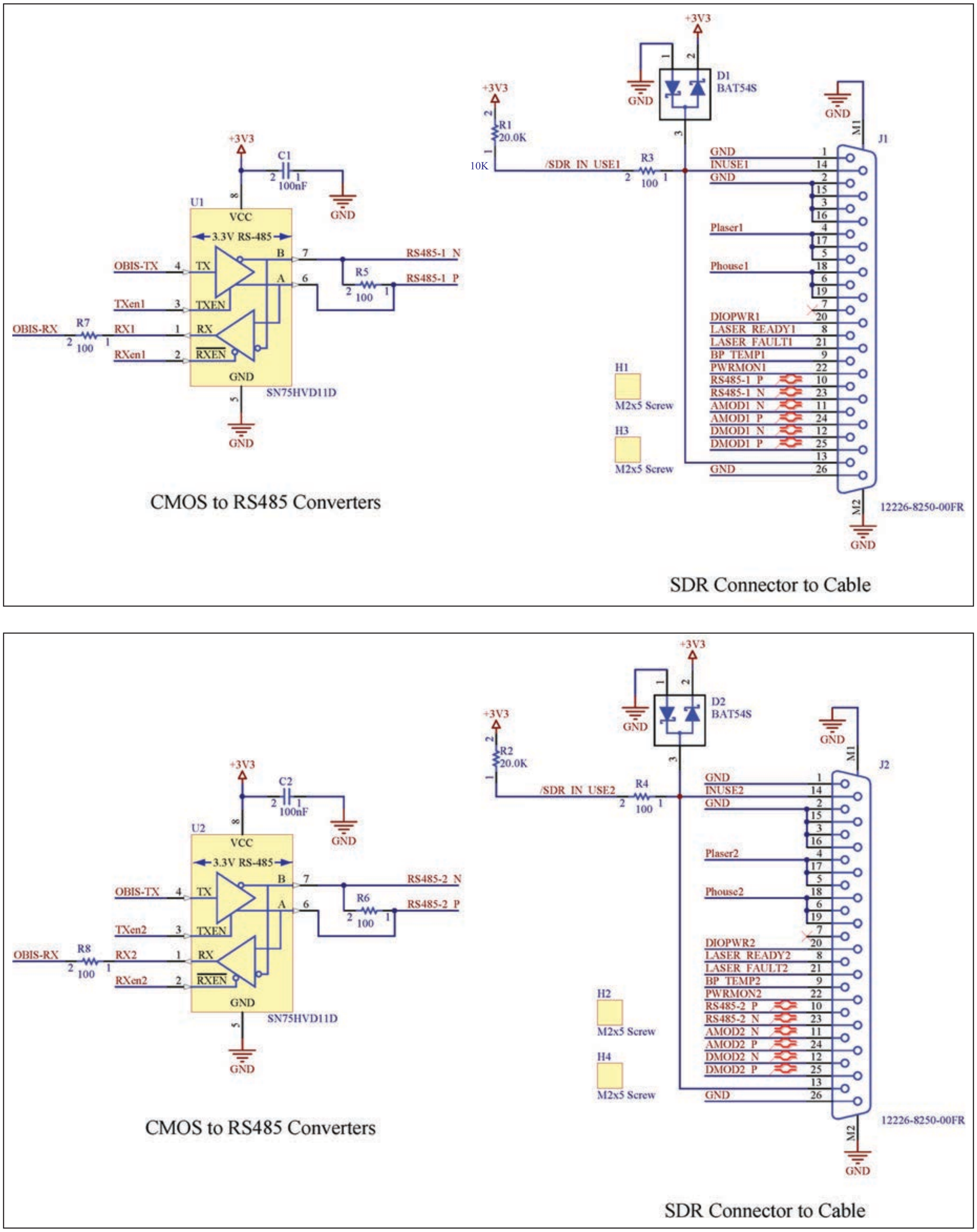


Figure F-1. OBIS RS-485 Interface Schematic

The required signals between the host and the OBIS Laser are listed in Table F-2.

Table F-2. OBIS RS-485 Interface Signals

SIGNAL	INPUT/ OUTPUT	DESCRIPTION	VOLTAGE LEVEL
OBIS-RX	Input	Receive data from OBIS Laser	3.3 VCMOS
/SDR_IN_USE 1, /SDR_IN_USE 2	Input	Pull up to 3.3V. Signal grounded by OBIS Laser when plugged into SDR port.	3.3 VCMOS 3.3 VCMOS
OBIS-TX	Output	Transmit Data to OBIS Laser	3.3 VCMOS
TXen1, TXen2	Output	Active High. Signal must go active to address the corresponding OBIS Laser.	3.3 VCMOS
+12V		Power to OBIS Laser	+12V
Ground		Ground	GND

All signals are driven at 3.3 volt CMOS logic levels. This scheme can be expanded to drive as many OBIS lasers as required. The /SDR_IN_USEx lines are pulled up by the host and grounded when an OBIS Laser is connected to its SDR cable. The host should use this line to enable or gate +12V power to the corresponding SDR port.

When the RS-485 bus is idle, all TXen lines must be low. To address a laser, the corresponding TXen line needs to be raised (and the RXen line lowered), and data transmission can start. When the last response is received, the host can drop the TXen line.

If a port's SDR_IN_USE line rises while its TXen line is high (indicating that the laser has been unplugged), the host should terminate transmission. Since the OBIS protocol is a strict master-slave, query-response relationship, there is no interrupt line from the laser to the host to initiate communication. The host should regularly round robin poll all SDR ports with a low logic level on their /SDR_IN_USE pin.

Figure F-2 shows the timing relationship between communication signals.

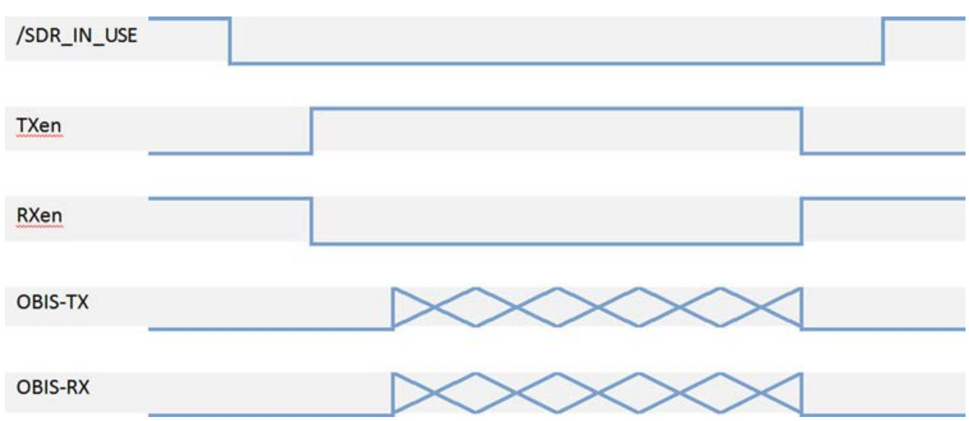


Figure F-2. Timing Relationship for Communication Signals

Coherent Connection Bus Functional Overview

The Coherent Connection Bus (CCB) is intended to provide message transmission between a single master device and one or more slave devices connected to the bus.

Two general categories of messages are exchanged:

- *Bus Management Messages* are used to manage bus operation, assign addresses, detect device disconnection, and notify client applications of bus events that may affect the client. These messages are sourced by CCB on both master and slave devices.
- *Standard Messages* are sourced by Client Application Software to implement a specific Application Protocol. Typically the client application running on the master device sends standard messages (commands or queries) to slave devices. After receiving a standard message the slave device responds in a manner defined by the received message, which may include replying to the master with another standard message containing query data or an acknowledgment that a command was received and acted upon.

A slave device must respond to a master's standard message request (non-broadcast) within 700 milliseconds before the master re-sends. The master retries sending up to three times before declaring a device disconnection event. The slave must reply in form of a general acknowledgment or a specific response. This implies that all messages have a 'handshake' mechanism. The master won't send another message type to the slave until it responds to the last message sent.

Message flow is always between master and slave devices, slave devices may not communicate with each other on a peer-to-peer basis.

Each device is assigned a unique address on the bus. The master device is always at fixed address 0. When slave devices power-up they utilize defined Bus Management Messages to request an address from the master device. After an address is acquired, the slave uses that address until the master assigns it a new address (usually at the next power cycle).

Master devices may utilize Bus Management Messages to poll (ping) devices on the bus. Polling is generally used to verify the presence of a device when it has not been heard from for awhile (for the purpose of device disconnection notification).

OEM RS-485 Hardware Design Requirements

The CCB protocol requires one RS-485 serial port for communication with the bus and a timer with sufficient resolution to detect idle line conditions.

The transmission collision detection function of CCB requires hardware that allows the receiver to be enabled while transmitting data. The software must be able to listen to what is being transmitted.

It is important that the bus be designed to prevent reflections that could cause data corruption, which normally is done with terminating resistors at each end of the bus.

Under some circumstances an RS-485 bus may operate without termination, which is desirable from the standpoint of simplification and power savings. However, elimination of reflections that could corrupt bus data takes precedence.

Bus design and termination requirements are beyond the scope of this document, but need to be taken into account during the hardware design phase.

Due to the nature of 2-wire half-duplex RS-485, it is important that the transmitter be disabled whenever a device is not actually transmitting data. Although a RS-485 bus can tolerate brief periods of time when more than one transmitter is driving the bus, it is extremely important that these time periods are kept to a minimum. It is therefore important that the length of time a transmitter is enabled be kept to a minimum.

If the hardware supports end of transmission interrupts (an interrupt that occurs after the final message bit has been sent), it is recommended that the transmitter is:

- Enabled at the very start of message transmission
- Disabled as soon as the end of transmission interrupt is generated.

Not all processors/UARTs provide for an end-of-transmission interrupt feature. When this is the case, it is acceptable to implement a circuit to perform Automatic Send Data Control (ASDC).

This feature automatically enables the transmitter at the beginning of data transmission and disables it immediately after the last stop bit has been sent. The book, *Serial Port Complete* (see “Applicable Documents” (p. F-34) describes several simple circuits that may be used to implement this feature.

If ASDC is not implemented, then the software requires another method to determine exactly when the last bit of the last message byte has been clocked out of the transmit register so the transmitter can be immediately disabled.

This requirement could be met with either:

- A UART that can generate an interrupt when the transmitter SHIFT register is empty (a feature that is somewhat rare), or
- A high-resolution timer that can provide an interrupt one character transmission time after the last message byte has been shifted into the transmit shift register (at 921.6kbs this could be as short as 11 µsecs), or
- Simply after receiving the last message byte that was transmitted.

However the transmitter is controlled, it is the responsibility of the implementing engineer to disable the transmitter whenever the device is not actually transmitting. This is necessary to prevent data corruption or seizure of the bus, which would prevent any other device communication.

A software implementation requires access to a timer that has sufficient resolution for detecting idle line conditions and expected event timeouts.

Each device on the bus must have a unique address. Historically assigning RS-485 addresses to devices has been the responsibility of the end user, typically by setting a series of DIP switches or by programming an address into non-volatile storage on the device.

Manual address assignment has some undesirable ramifications, including increased costs for hardware, customer training, and documentation; bus operation and troubleshooting problems caused by duplicate addresses; difficulty in swapping out devices; and problems due to misunderstandings or errors on the part of users.

To eliminate manual address assignment, the CCB protocol allows for a system of automatic address assignment. This relieves the client hardware of any addressing responsibilities.

Message Structure

All messages sent across the CCB contains a common five-byte header. A message may optionally include up to 255 bytes of data.

The five-byte header is organized as shown in Table F-3.

Table F-3. CCB Message Header

BYTE	ABBREVIATED NAME	FUNCTION
0	Sadd	Source device address
1	Dadd	Destination device address
2	Flags	Message Flags byte
3	Tag	Arbitrary value
4	Len	Data Length

The Flags byte is set by the master device when a command or query transaction is initiated. The responding device returns the Flags byte received in a command or query in any resulting reply message.

The Tag byte is an arbitrary value passed from the original sender through to the destination device. The responding device returns the unmodified Tag byte received in a command or query in any resulting reply message. This byte may be used by the originating node to associate a reply message with the initial command/query message.

One possible implementation would be to use an incrementing counter as the tag value for each initiating message sent. This way, the sender could easily determine if a reply was dropped between consecutive messages.

When the message contains no additional data, the Len byte is set to 0. This type of message may be used exclusively by the Bus Management function and not used by client applications.

When the message contains additional data, limited to 255 bytes, it is appended to the four-byte header and the header Len byte set to the length of the additional data segment.

Message Framing

Because CCB messages may vary in length, it is necessary to indicate the start and end point of each message, as shown in Figure F-3.

SOM	Sadd	Dadd	Flags	Tag	Len	Data	EOM

Figure F-3. CCB Message Framing

The CCB protocol prefixes a SOM (Start of Message) indication to the beginning of the message, populates the source address (Sadd field above) with the local device address, sets any flags appropriate to the type of message being sent, and appends an EOM (End of Message) indication to the end of the message.

Both binary and ASCII data may be transmitted. For this reason, it is not possible to use a single byte to indicate the start or end of a message, since it would be impossible to determine if the byte value represented a start/end of message handshaking character or a valid message data byte.

Assuming that a message packet begins with a single STX character (value 0x02) and ends with a single ETX character (value 0x03), consider the binary message packet shown in Figure F-4:

0x02	Sadd	Dadd	Flag	Tag	Len	D_0	D_1	D_2	0x03
	0x00	0x01	0x01	0xnn	0x03	0x02	0x10	0x22	

Figure F-4. Binary Message Packet

The intent of this message is to represent a single binary message packet. However, it contains ambiguities. The Len byte of 0x03 may be interpreted as an ETX since it has the same value. Similarly, the D0 value of 0x02 may be interpreted as an STX instead of a data byte as was intended. So, instead of a single binary message, this packet could be interpreted as two separate messages and there is no unambiguous method that software can use to guarantee correct interpretation.

To resolve this problem, the framing logic incorporates an escape feature. During transmission, any byte value that is intended to function as a handshake character must be preceded by a DLE character (Data Link Escape, ASCII value 16 decimal or 0x10 hex). This method also requires that any byte in the transmitted data stream with the same value as DLE be sent as two consecutive DLEs.

Using this method, the example above would be framed as shown in Figure F-5:

0x10	0x02	Sadd	Dadd	Flag	Tag	Len	D_0	0x10	D_1	D_2	0x10	0x03
		0x00	0x01	0x01	0xnn	0x03	0x02		0x10	0x22		

Figure F-5. Example Using DLE Character

When the leading 0x10 DLE character is read, it “escapes” the very next byte, which is then interpreted unambiguously as an STX byte. In this way, it is easy to identify that sequence as the start of a message. When the Len byte of 0x03 and the D0 byte of 0x02 are read, they are not interpreted as ETX or STX framing characters because they were not immediately preceded by DLE bytes. The D1 value of 0x10, however, is a valid data byte so must be preceded by DLE.

As data is read from the bus, each time the DLE character is encountered the next byte is interpreted as a handshake character. Two consecutive DLE characters are interpreted as one data byte with value equal to DLE.

In summary:

- A DLE, STX sequence always represents the start of a message (the SOM sequence)
- A DLE, ETX sequence always represents the end of a message (EOM sequence)
- A DLE, DLE sequence always represents a single data byte with value 0x10 as part of the message body

Table F-4 lists the CCB protocol framing characters.

Table F-4. CCB Protocol Framing Characters

ASCII CHARACTER	HEX VALUE	PROTOCOL FUNCTION
STX	0x02	Start of message data
ETX	0x03	End of message data
DLE	0x10	Data Link Escape

Any DLE escape characters added to the message data are not reflected in the message length field of the message. The message length field is only guaranteed accurate at the application layer. The protocol stack does not use the message length field in determining how many bytes to send or receive. A complete message is framed by SOM/EOM sequences.

The last step of message framing involves computing a checksum and appending it to the message. This is covered in more detail under "Outbound Message Framing Function" (p. F-13).

Address Allocation

Device addresses are one byte in size allowing a total of 255 possible addresses. Some of these addresses are reserved for specific purposes.

Table F-5 lists the device address allocated for CCB Addresses.

Table F-5. CCB Address Allocation

DEVICE ADDRESS	FUNCTION
0	Master device
0x01-0xfd	Unique addresses assigned to slave devices
0xfe	Power up default slave address
0xff	Broadcast address (all slave devices respond to this)

The master device is always at address 0 and should power-up with this address.

Address 0xfe is the power up default address of all slave devices and also the address a slave reverts to following reception of a Bus Reset message. The automatic address assignment function then assigns a unique address in the 0x01–0xf d range to slave devices.

Address 0xff is a broadcast address. All slave devices receives messages sent to the broadcast address.

Message Flags Byte

The Message Flags byte contains bits that are used for various purposes, listed in Table F-6.

Table F-6. Message Flags Bit Definitions

BIT	NAME	FUNCTION
0	BUSMGMT	Message is a bus management message
1	SRCCCB	Message originated from CCB stack
2	SRCCONT	Message originated from master device (controller)
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	

The BUSMGMT bit is set on any BUS MANAGEMENT message. When this bit is set on an originating message, the destination protocol stack handles the message response rather than passing it up to the destination application for processing. There is nothing to prevent the application layer on a master device from sending bus management messages, but the protocol stack on the destination device always handles the response. The BUSMGMT flag should be used to do the address assignment, ping, and bus reset commands.

The SRCCCB bit is set on messages that are exchanged between CCB protocol stacks. This bit is used to determine message response routing. If the SRCCCB bit is set on a message, then the message is always handled by the protocol stack.

The SRCCONT bit is set on messages that are sourced by the application layer on a master device (usually a controller). These messages are routed to the application layer on the controller device. *Use the SRCCONT flag to do all the SCPI commands and queries*.

When SRCCCB and SRCCONT are both clear a message is passed on to the host.

LRC Computation

A checksum is computed on each message during framing and sent as the last byte of a message following the two-byte EOM sequence.

The CCB checksum algorithm uses a simple Longitudinal Redundancy Check with a seed value of 0xff. The entire message frame (including SOM and EOM sequences, the message body, and all inserted DLE escape characters) are included in the calculation. Pseudo code for the algorithm is as follows:

```
Set LRC = 0xff
For each byte c in the message
do
      Set LRC = LRC XOR c
end do
```

Example of a Framed Command and Response Over RS-485

The following example illustrates a framed command and response over RS-485 for checking laser status with handshaking turned on. Non-ASCII data is represented in hexadecimal format delimited by []. For example, decimal 16 is represented as 0x10 in hex and is shown as [10].

```
(Master) Command TX:
[10][02][00][DF][04][00][0D]SYST:STAT?[0D]
[0A][00][10][03]
[35]
(Slave)     Response RX:
[10][02][DF][00][04][00][0F]00000180[0D][0
A]OK[0D][0A][00]
[10][03][27]
```

For additional examples (written in C code), refer to the **`CCBparser.zip`** file. This file is available for download from the Coherent website:

https://www.coherent.com/assets/software/CCBparserExample.zip

Example of a Complete Query and Answer via RS-485

The following example shows what to send over RS-485 to activate the handshaking in the OBIS.

First, do the address assignment to establish communication:

Figure F-6 shows Binary Data sent over the bus with an OBIS address of 3:

0x10	0x02	0x00	0xFF	0x01	0x00	0x03	0x80	0x03	0x00	0x10	0x03	0x80

Figure F-6. Activate Handshaking Using RS-485

Now send the handshaking command/query over the bus. The following example is 36 characters.

```
SYSTem:COMMunicate:HANDshaking ON\r\n
```

This results in a binary data sent over the bus, as shown in Figure F-7:

0x10	0x02	0x00	0x03	0x00	0x00	0x24	0x53	0x59	0x53	0x54	0x65	0x6D
0x3A	0x43	0x4F	0x4D	0x4D	0x75	0x6E	0x69	0x63	0x61	0x74	0x65	0x3A
0x48	0x41	0x4E	0x44	0x73	0x68	0x61	0x6B	0x69	0x6E	0x67	0x20	0x4F
0x4E	0x0D	0x0A	0x00	0x10	0x03	0xE5						

Figure F-7. Binary Data Sent Over the Bus

The LX responds with "OK\r\n", as shown in Figure F-8:

0x10	0x02	0x03	0x00	0x00	0x00	0x05	0x4F	0x4B	0x0D	0x0A	0x00	0x10
0x03	0xFB											

Figure F-8. Response to Query

Make sure to use Complete Termination \r\n.

OBIS RS-485 communication enforces use of both the carriage return AND newline characters at the end of the command/query string.

Not including the '\n' causes the CCB stack to return an 'ACK' because the datalink layer saw a valid message, but the application layer didn't understand it. This results in a return of error code "-220" ("Invalid Parameter") when sending the next command or query.

This event only occurs when talking over RS-485.

Outbound Message Transmission

Recommended Outbound Message Functional Flow

Figure F-9 shows the recommended functional flow for an outbound message.

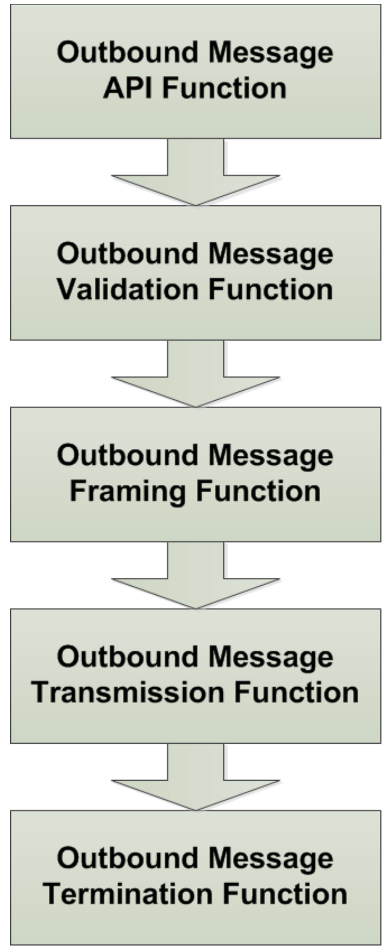


Figure F-9. Outbound Message Flow

Outbound Message Validation Function

Input Requirements

An outbound message validation function receives fully assembled outbound messages from the outbound message function.

Processing Requirements

The following validations are performed on outbound messages received from the function.

1. The destination address is a valid address.
2. The destination address does not equal the local device address (a device cannot send a message to itself).
3. If the message is a broadcast message, the local source address must be zero.

Output Requirements

If any of the validation tests fails, the failure event is passed to the Outbound Message Termination Function for return to the client.

If all validation checks are successful, the message is passed on to the Outbound Message Framing Function for further processing.

Outbound Message Framing Function

Input Requirements

An outbound message framing function receives validated messages from the outbound message validation function.

Processing Requirements

The Outbound Message Framing Function constructs outbound message packet frames for transmission using the format shown in Figure F-10 (p. F-13).

The resulting message packet is fully framed using the following sequence:

1. The first two bytes of the message contain the two-byte SOM marker (DLE, STX)
2. Each byte of the message, as received from the Outbound Message Validation Function, is appended to the SOM.

   As each byte is appended, its value is compared to the DLE value. If the data byte is equal to DLE, then the data byte is appended to the message as two consecutive DLE bytes. **Note that any DLE expansions in the message body after framing cause the Message Body Length byte to be invalid during transmission. After the DLEs are stripped by the receiver, the Length byte is again accurate.**
3. Append the two-byte EOM sequence (DLE,ETX) to the message modified message data.
4. Compute the LRC for all message bytes and append it to the message.

At this point, the assembled packet may be passed to the Outbound Message Transmission Function for further processing.

Figure F-10 shows how a simple message from the master (source address 0) is framed following the framing function. Notice how the D1 byte, with a value of 0x10 that is equal to DLE, is preceded by another DLE byte.

The LRC byte is computed and transmitted by the Outbound Message Transmission Function, but the LRC is NOT appended to the message by the framing logic.

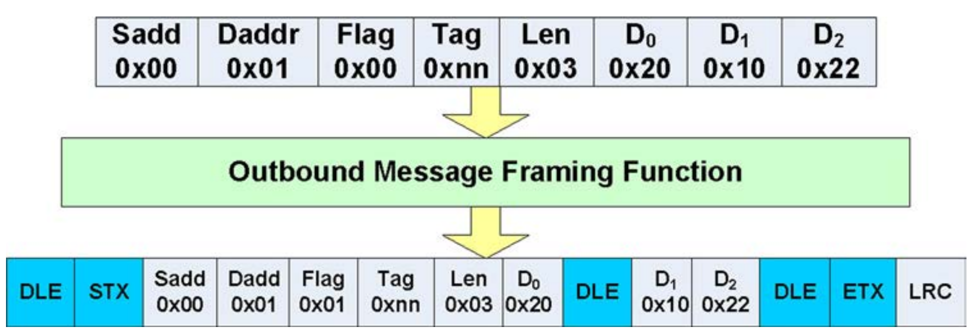


Figure F-10. Outbound Message Framing

Output Requirements

The fully framed message assembled by the Outbound Message Framing Function is passed to the Outbound Message Transmission Function.

Outbound Message Transmission Function

Input Requirements

The Outbound Message Transmission Function receives a fully assembled and framed message from the Outbound Message Framing Function.

Processing Requirements

The Outbound Message Transmission Function transmits the complete message packet to the destination address and returns the transmission results back to the Outbound Message Termination Function.

Message transmission involves the following steps performed in sequence; however, the task is more complex when error checking and retries are performed.

1. Wait for idle bus condition
2. Transmit the entire message. Each byte transmitted is echoed back and buffered as received.

Devices that use idle frame detection to detect the end of a received message are very sensitive to interbyte timing. For this reason the maximum time between any two message bytes cannot exceed the time it takes to transmit one character frame at the current baud rate. Doing so causes invalid End-Of-Message (EOM) detection on the receiving device.

---

3. Compare transmitted message and received message byte-by-byte, looking for a mismatch
4. If the received message does not match the transmitted message, perform collision-based retries

The flow chart in Figure F-11 (p. F-15) depicts the logical flow of message transmission including collision detection and retries.

The following sections describe these operations in more detail.

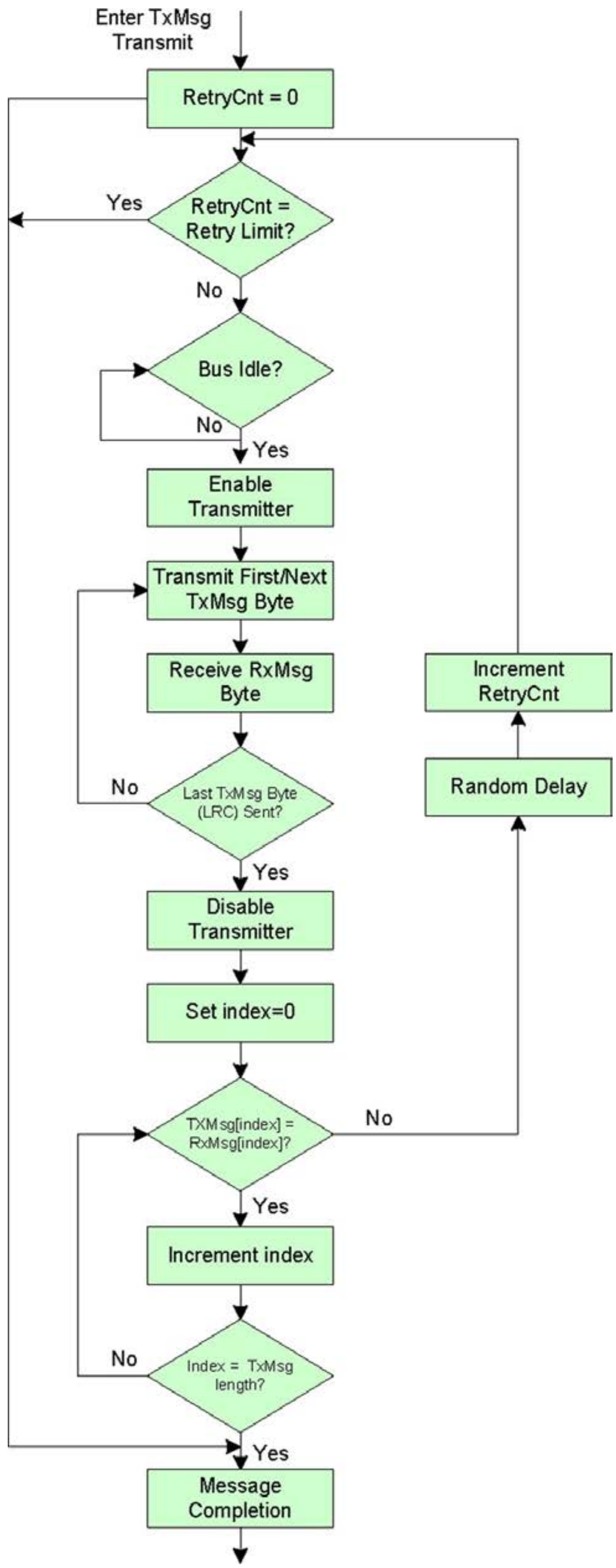


Figure F-11. Outbound Message Transmission Flow

Transmitter Control

If the hardware supports the recommended Automatic Send Data Control hardware, then enabling/disabling of the transmitter is done in hardware and may be ignored.

However, if ASDC is not available in hardware, the software must ensure that the transmitter is enabled only during message transmission and disabled immediately upon transmission of the last stop bit in the last byte of the message (the LRC byte).

Message Transmission Retries

When message transmission fails due to a bus collision, the transmit function attempts a maximum of *N* retries (default four). *N* may optionally be made an adjustable parameter.

Idle Bus Detection

Message transmission does not commence until a bus idle condition is detected.

The bus idle condition is defined as the bus being in a spacing state for a period of three character transmission times (30 bit times).

Idle Time = (1/BaudRate)*30

At a baud rate of 921600 bps, the bus spacing state must exist for ~32.5 µs for the bus to be considered idle.

Collision Detection

Collision detection requires that the hardware support enabling of the receiver during data transmission.

During message transmission, the receiver circuit is enabled. This results in a character being received each time a character is transmitted. As the message is transmitted, the resulting received data should be buffered.

After the message and checksum have been transmitted, a byte-by-byte comparison is performed between the transmitted message and the resultant received message.

- If the messages are identical, then no collision occurred.
- If, however, the messages differ in any way, a collision or other data corruption event occurred.

In the event of collision or corruption, the Outbound Message Transmission Function waits for a random delay period to pass and then retries message transmission from the beginning.

Transmission retry attempts repeats until a complete uninterrupted message has been successfully transmitted without collision, or until all retry attempts have been exhausted.

Random Delay

If a collision or corruption is detected during message transmission, it is important that each device detecting a collision on the bus (that is, each transmitting device involved in the collision) wait a random period of time before attempting transmission.

The algorithm used to determine the back-off and retry delay is a truncated binary exponential back off algorithm. *Truncated* means that, after a certain number of increase, the exponentiation stops—that is, the retransmission timeout—reaches a ceiling and thereafter does not increase any further.

After *i* collisions, a random number of slot times between 0 and 2^i - 1 is chosen. After the first collision, the sender would wait 0 or 1 slot times before retry; after the second collision it would wait 0-3 slot times, etc. After the fourth and subsequent consecutive collisions, the slot time delay is limited to 0-15 slot times. Note that there is no provision for discarding a message after many collisions; message transmission retries until it succeeds.

A slot time is defined as the time to transmit 64 characters at the selected baud rate. The slot time is computed as ceil((1/baudrate)*640). At 921600 bps, the slot time would be:

(1/921600)*640 = 0.00069, or 690 microseconds

Inbound Message Transmission

Inbound Message Functional Diagram

Figure F-12 shows a functional diagram for the Inbound Message flow.

Inbound Message Receiving Function

Input Requirements

The Inbound Message Receiving Function is an event driven function that is kicked off when a data byte is received from the CCB.

Processing Requirements

Data bytes are read from CCB port and scanned to identify complete messages. A complete message includes the two-byte SOM sequence, all bytes that immediately follow SOM through the two-byte EOM sequence that frames the message, and the LRC byte that immediately follows the EOM sequence.

Conceptually, message reception involves the following steps, performed in sequence (some implementation details left out for clarity):

1. Scan the incoming data stream looking for a SOM sequence.
2. After SOM is discovered, buffer data, compute LRC and scan for an EOM sequence while limiting any received message to the maximum allowable length.
3. When EOM sequence found, read the LRC checksum byte that follows EOM.
4. Compare the received checksum byte to the computed LRC.
5. If checksum values are equal, a complete message was received.
6. Compare the received checksum byte to the computed LRC.
7. If checksum values are equal, a complete message was received.

Figure F-12 shows the functional flow for an Inbound Message.

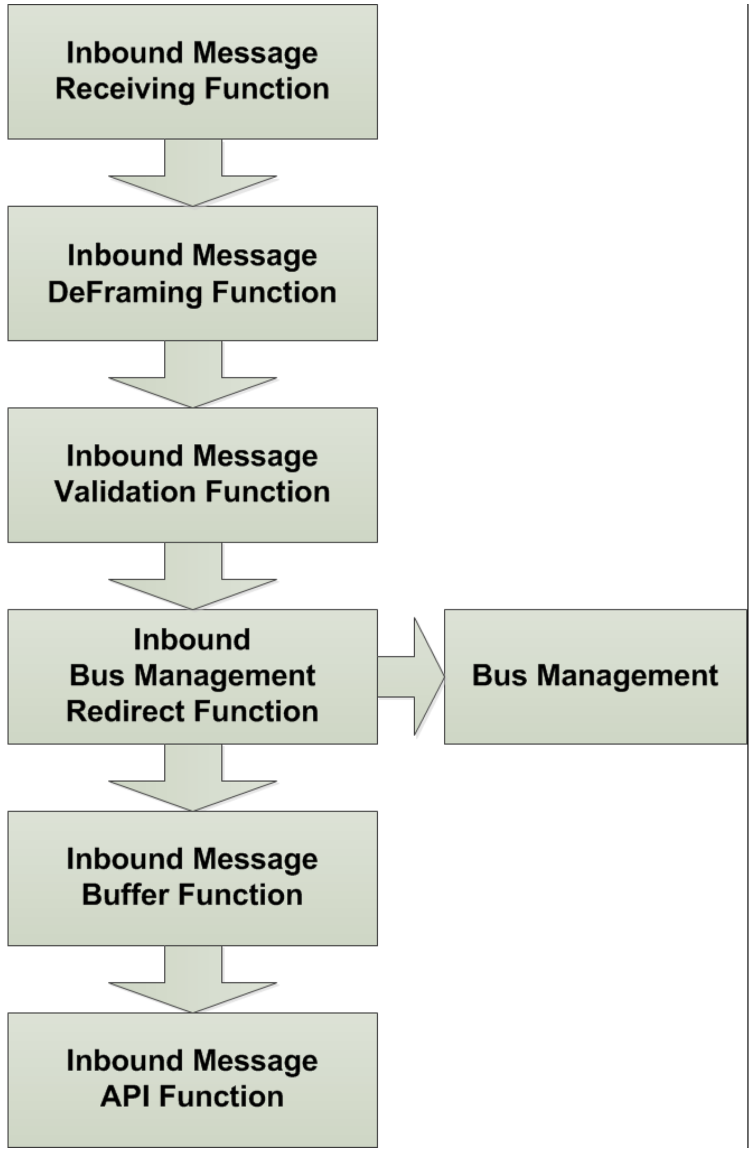


Figure F-12. Inbound Message Flow

Output Requirements

Complete received messages passing checksum validation are passed to the Inbound Message Deframing Function.

Figure F-13 shows the Receiving flow for an Inbound Message.

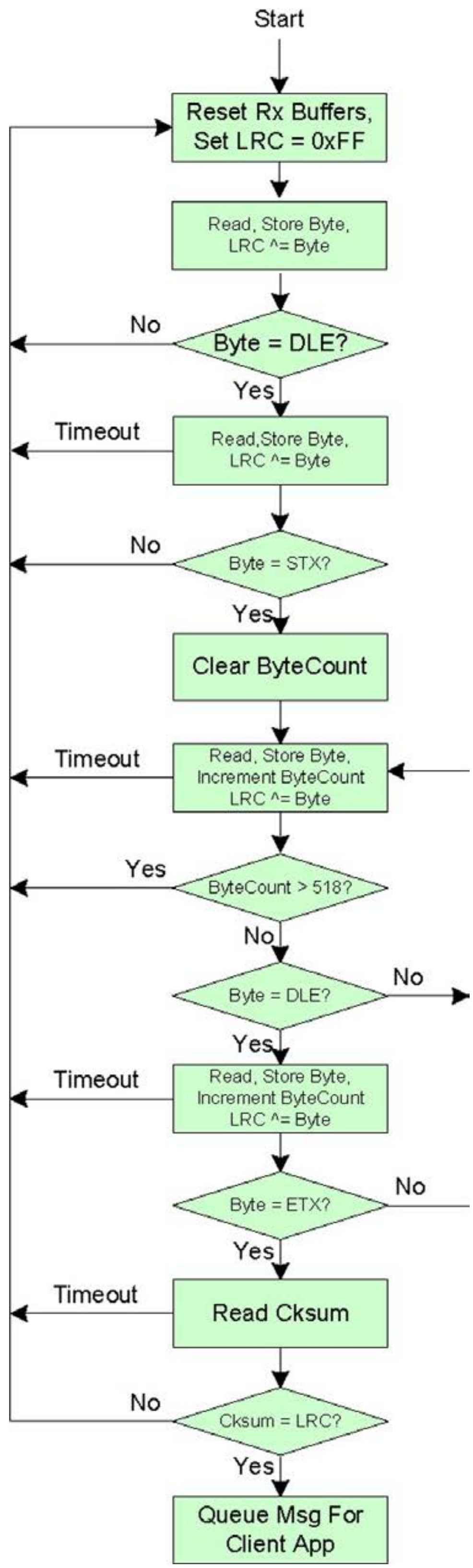


Figure F-13. Inbound Message Receiving Flow

Inbound Message Deframing Function

Input Requirements

The Inbound Message Deframing Function receives complete messages that have passed checksum validation from the Inbound Message Receiving Function.

Processing Requirements

The Inbound Message Deframing Function removes all framing characters from received messages so subsequent functions can easily validate the message and buffer it for the client.

Framing characters are removed from inbound messages using the following rules:

1. Strip the two-byte SOM sequence from the beginning of the message.
2. Perform a byte-by-byte copy of the received message into a new message buffer. As the copy proceeds each byte is compared to DLE. When a DLE is encountered, it is discarded and the very next byte from the received message is taken literally and placed in the new message buffer without regard to value. Bytes placed in the message buffer are counted to determine the exact message length.
3. When the two-byte EOM sequence is encountered the scan terminates. EOM bytes are not stored in the new message buffer or counted.

Figure F-14 depicts the deframing logic.

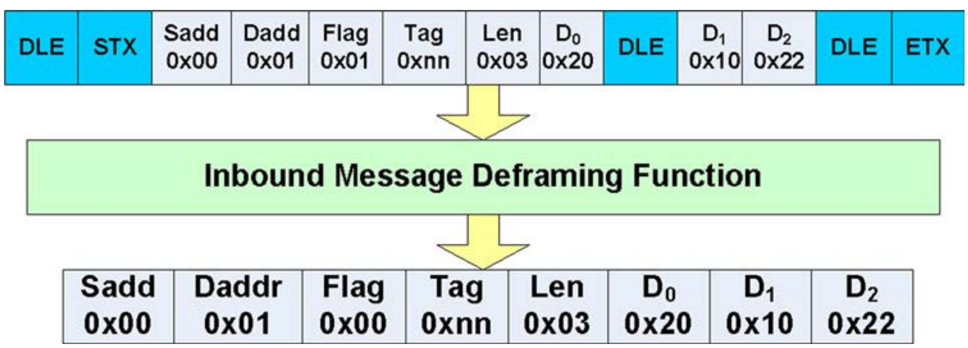


Figure F-14. Deframing Inbound Messages

Output Requirements

The Inbound Message Deframing Function passes the new message buffer and the size of the new message to the Inbound Message Validation Function.

Inbound Message Validation Function

Input Requirements

The Inbound Message Validation Function receives deframed messages and their associated length from the Inbound Message Deframing Function.

Processing Requirements

Because the CCB is a bus, all messages that are sent on the bus are received by all connected devices. It is necessary to ignore messages that are not intended for the local device.

When a newly deframed message is received, the Inbound Message Validation Function accepts messages according to the following rules:

1. If the local device is a Master device (local address 0), messages are accepted only when the message destination address is 0.
2. If the local device is a Slave device, messages are accepted when either of the following statements is true:
   - The destination address equals the local device address
   - The destination address is 0xff (broadcast message)
3. All other messages are discarded.

Output Requirements

Validated Inbound messages are passed to the Inbound Bus Management Handling Function.

Inbound Bus Management Redirect Function

Input Requirements

The Inbound Bus Management Redirect Function receives validated inbound messages from the Inbound Message Validation Function.

Processing Requirements

The BUSMGMT bit of the Message Flags byte of each inbound message is examined to determine if the message should be buffered for the client or processed by the Bus Management Function as a bus management message:

- If the BUSMGMT bit of the Message Flags byte is set, the message is a bus management message.
- If the BUSMGMT bit of the Message Flags byte is clear, the message is a client message.

In all cases, this function updates an active device list with a timestamp indicating the last time a message was received from the device. The timestamps on the active device list are used by the Bus Management Device Disconnection Detection function to determine when to ping inactive nodes for the purpose of detecting disconnected devices.

Output Requirements

Inbound messages that are bus management messages are passed to the Bus Management Function.

Inbound messages that are not bus management messages are passed to the Inbound Message Buffer Function.

The updated timestamps for active devices are made available to the bus management function as a required part of device disconnect detection logic.

Inbound Message Buffer Function

Input Requirements

The Inbound Message Buffer Function receives validated, non-Bus Management messages from the Inbound Bus Management Function.

Processing Requirements

Received messages and their associated size are buffered for reading by the client application through the API in a first in, first out, fashion.

A maximum number of messages is buffered. The default value is 6, and that value can be configured. Only complete messages are buffered; if there is not enough buffer space remaining for a new message, the message is discarded.

This function maintains a count of the number of messages currently buffered.

Output Requirements

The number of buffered messages is made available to the Inbound Message API Function.

Inbound Message API Function

Input Requirements

Inbound messages are read when a Client Application calls the inbound message API function.

Processing Requirements

The API function is a blocking call. If no messages are currently buffered, the function does not return until a message arrives to satisfy the read request.

Output Requirements

On success, an *N* byte message is stored in the specified client read buffer.

Bus Management

Bus Management Overview

Each device participating on the CCB requires a unique address. Additionally, since the CCB hardware has no way to identify when devices are connected or removed from the bus, it must be done in software. Lastly, since the CCB is a "cloud" rather than a collection of point-to-point connections, it may be necessary to identify which slave device is connected to a each port. To manage these requirements the CCB Bus Management Logic implements for five specific functions:

1. Detection of newly connected slave devices on the bus
2. Assignment of unique addresses to slave devices
3. Associate master device ports to specific slave devices
4. Detection of slave devices that are no longer responding on the bus
5. Apprise client application on master device of bus status

Master and Slave devices are assigned unique bus management roles.

Slave devices perform the following bus management functions:

- Acquire a unique bus address from the master device
- Conditionally respond to port identification requests
- Respond to ping requests from the master device

The Master device perform the following bus management functions:

- Issue a Bus Reset command at start-up to reset connected slave devices
- Respond to slave address requests with a unique bus address assignment

- Perform port detection logic to associate slave devices to physical ports
- Issue ping requests to devices that have not been active for a period of time
- Maintain a list of all devices on the bus using serial number as unique identifier
- Allow client application to query the list of active slave devices on the bus
- Notify client application as devices are attached and detached from the bus

The bus management command and reply protocol utilizes the same message header used by the application protocol; however, bus management message packets are uniquely identified by the BUSMGMT bit in the message flags byte. When a message is received with the BUSMGMT bit set, it is passed to the bus management function for handling instead of being passed to the client application.

The following subsections provide overviews of the above functionality.

Bus Management Address Assignment Overview

The Master device always powers up at fixed address 0. At Power-up, the master device issues a single Bus Reset command to place any configured slave devices into an Address Acquisition mode.

Slave devices always power up at an initial and temporary address of 0xFE, and also assume address 0xFE following reception of a Bus Reset command.

The slave then assembles and transmits an address acquisition request—which includes the unique slave device serial number—to the master device at address 0. Although not enforced by the CCB stack, this is the only unsolicited message that a slave device is allowed to transmit.

When the master device receives a valid address acquisition request, it assembles an address assignment response packet—which contains the device serial number as received in the Address Request packet and also a unique bus address—and transmits it to the temporary address of 0xFE.

When a slave device receives an address assignment packet containing its unique serial number, it resets its local address to the new address contained in the message and then proceeds with normal bus operation. **NOTE:** The slave device does not explicitly acknowledge it received the address assignment packet.

Until a slave address has received an address assignment from the master device, it ignores all bus commands, except address assignment commands containing its unique serial number, and continue to transmit address acquisition requests using the defined CCB collision detection, back off, and retry method. If the address assignment packet isn't received in a timely manner, the slave device performs timeout and retries every two seconds until an address is acquired.

The address acquisition requests and reply packets are described under “Bus Management Address Acquisition Protocol” (p. F-30).

Bus Management Ping Overview

The CCB provides no facility for detection of device disconnection events. The only way to know if a device is connected to the bus is when a message is received from it.

The master maintains a master list of devices that have been assigned addresses and are connected to the bus.

The CCB stack on the master performs a background polling loop of connected devices.

If a message has not been received from an assigned address for a period of time (default 10 seconds, configurable), the master CCB stack sends a ping message to the address and waits a period of time (default 2 seconds, configurable) for a response.

When a slave device receives a ping message from the master, it then assembles and transmits a ping response message. This lets the master know that the slave device is still there.

When a device has not responded to a ping transmission in three consecutive attempts, the address is marked as available and the client application on the master is informed that the device has been disconnected from the bus.

Bus Management Client Interface Overview

Client applications on the master device typically require the ability to know what devices are on the bus, and also when new devices are connected and old devices disconnected.

The Master device implements an API function that the client code may call to retrieve a list of all devices connected to the bus at the time of the call.

The Master device also queues a message for the client to read whenever new devices are connected to the bus (when addresses are assigned) or when old devices are disconnected from the bus (when addresses are released).

The Client application on the master would typically retrieve a list of all addresses at start-up and then use the queued bus management event messages to keep the list updated from that point on.

Bus Management Port Identification Overview

The Master Controller contains LED indicators to represent the current status of various slave device operational parameters. These LEDs are associated to specific physical ports on the master controller.

However, the CCB is a "cloud" architecture, where the location of specific devices on the bus is not fixed or easily identifiable. Without special logic it is impossible for software to know which physical port a slave device is connected to.

The Bus Management Port Identification logic is thus implemented to identify the physical port to which a slave device is attached. In this way, the LED indicators for that port properly represents the status of the correct device.

The Master Controller has direct control over a signal pin on the connector of each port (herein referred to as the Port Identification Pin, or PIP). For each port, it asserts the PIP and then broadcasts a bus management port identification request. Upon receipt of this message each slave device examines the state of its PIP. If PIP is asserted, the slave device responds with a port identification response. The master controller then knows which slave device is attached to that port. The PIP on the identified port is then de-asserted and this method is repeated for each port on the bus. This logic must be performed at power up and also each time a device is connected to the bus.

Master Device Bus Management Functional Flow

Figure F-15 shows the flow diagram for the Master Device Bus Management.

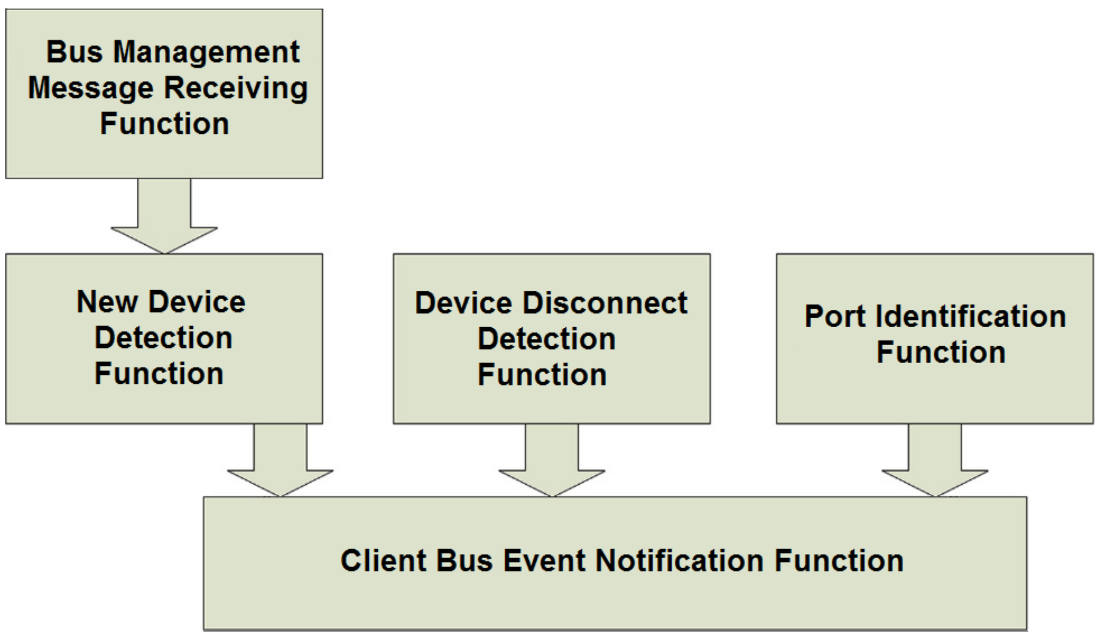


Figure F-15. Master Device Bus Management Flow Diagram

Bus Management Message Receiving Function

Input Requirements

Bus Management messages are received from the Inbound Bus Management Redirect Function when the BUSMGMT bit in the message flags byte is set in a received message.

Processing Requirements

If the received bus management message is a Ping Response message from a slave device, it is discarded and no further action taken.

Ping Response messages have served their purpose by causing the device's last received message timestamp to be updated in the Inbound Bus Management Redirect Function.

Output Requirements

All received messages that are not slave device Ping Response messages are passed to the New Device Detection function.

New Device Detection Function

Input Requirements

The New Device Detection function receives bus management messages from the Bus Management Message Receiving Function.

Processing Requirements

Each received bus management message is examined to see if it is an address acquisition request message from a newly connected slave device.

If the received message is identified as an Address Acquisition Request message, the following processing steps are performed:

1. A scan of connection devices is made to remove duplicate serial numbers from list.
2. An unused address is allocated from the address pool and assigned to the device.
3. The device serial number is stored for the new address.
4. The last received message timestamp on the address is recorded.
5. An Address Assignment message is assembled as explained in the section, “Master Device Address Assignment Response” (p. F-30) and then transmitted to the slave device.

Output Requirements

If the results of the New Device Detection Function resulted in assignment of a new device address, the event is passed to the Client Bus Event Notification Function and no further action on the message is taken.

If the message does not result in the assignment of a new device address, the message is discarded and no further action taken.

Device Disconnection Detection Function

Input Requirements

The Device Disconnection Detection Function is entered on a timed basis once each second.

Processing Requirements

The Device Disconnection Detection Function scans the active device list to determine the period of time that has elapsed since the last message was received from each active device.

For each active device, if the elapsed time is greater than the maximum dead time limit (default 6000 milliseconds, configurable), the device address is marked as inactive and a list of all newly inactive devices is assembled.

For each active device, if the elapsed time is less than the dead time limit, but greater than the minimum dead time limit (default 2000 milliseconds, configurable), a Master Ping Request message is assembled and transmitted to the device and no further action is taken.

Output Requirements

If any devices were newly discovered to be disconnected, the list of such devices is passed to the Client Bus Event Notification Function.

Port Identification Function

Input Requirements

The Port Identification Function is entered at power up and each time a slave device is connected to the master device.

Processing Requirements

For each physical port on the master device, the Port Identification Function performs a port identification sequence.

The port identification sequence operates as follows:

1. Assert PIP on one port and de-assert on all other ports.
2. Broadcast a Port Identification Request.
3. Wait for a response from a slave device for a maximum of 100 ms. If there is no response, one retry is attempted per port.

Output Requirements

On exit from this function all PIPs is de-asserted.

The master device maintains an internal “Port Association List” that associates each physical port to a specific slave device, if any. Slave devices are uniquely identified by a device serial number.

Client Bus Event Notification Function

Input Requirements

The Client Bus Event Notification Function receives input from two sources:

1. New Device Detection Function
2. Device Disconnection Detection Function

The New Device Detection Function supplies the address and serial number of the newly detected device.

The Device Disconnection Detection Function supplies a list of all devices that have been disconnected.

Processing Requirements

For each new device detected, the Client Bus Event Notification Function assembles a Slave Device Connection Message and queues it for the client.

For each device that has been disconnected, the Client Bus Event Notification Function assembles a Slave Device Disconnection Message and queues it for the client.

Output Requirements

This function produces no output.

Slave Device Bus Management Functional Flow

Figure F-16 shows the functional flow for Slave Device Bus Management.

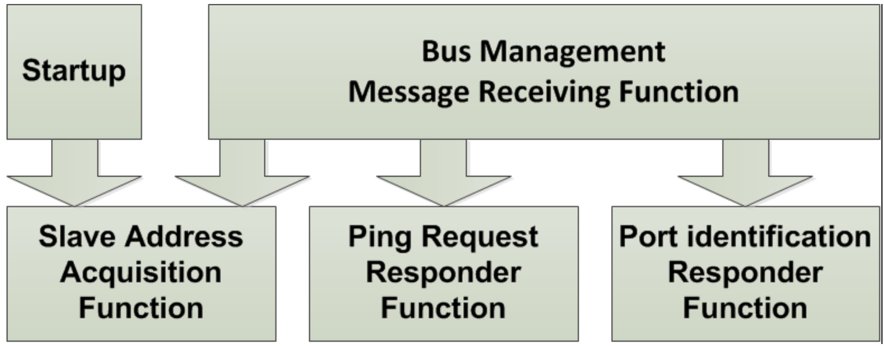


Figure F-16. Slave Device Bus Management Functional Flow

Slave Address Acquisition Function

Input Requirements

This function is entered when any of the following conditions occur:

1. Initial power up of the slave device
2. Reception of a Bus Reset message from the master device
3. Timeout while waiting for an Address Assignment message from the master device
4. Arrival of an Address Assignment message from the master device

Processing Requirements

The slave CCB stack sets its local device address to 0xFE at power up, following reception of a Bus Reset command from the master device.

It then assembles and transmits an Address Request message, including the device serial number string, to the master device at address 0 and set a two second timeout.

Each time an Address Assignment message is received, the serial number on that message is compared with the local device serial number.

If an Address Assignment message is received with matching serial number, the local device address is set to the newly assigned address and the timeout canceled.

If the timeout expires before an acceptable Address Assignment message has been received, another Address Request message is sent and another two second timeout is set.

This cycle repeats until an Address Assignment message is received with matching device serial number. When an address has been successfully acquired, the Address Acquisition function is considered complete.

If an Address Assignment message with matching serial number is received subsequent to initial address assignment, the local device address is reset to the newly assigned address.

Output Requirements

The slave acquisition function is not considered complete until a unique local address has been acquired and set.

Slave Bus Management Message Receiving Function

Input Requirements

Bus Management messages are received from the Inbound Bus Management Redirect Function when the BUSMGMT bit in the message flags byte is set in a received message.

Processing Requirements

The message is examined and dispatched to the proper message handling function.

Output Requirements

If the received message represents an Address Assignment Message or a Bus Reset Message, the message is passed to the Slave Address Acquisition Function.

If the received message represents a Ping Request Message, the message is passed to the Slave Device Ping Responder Function.

If the received message represents a Port Identification Request Message, the message is passed to the Slave Device Port Identification Function.

Slave Device Ping Responder Function

Input Requirements

The Slave Device Ping Responder Function receives messages from the Inbound Bus Management Redirect Function when the BUSMGMT bit in the message flag bit is set and the message represents a master Ping Request.

Processing Requirements

The Slave Device Ping Responder function assembles and transmits a Ping Response message to the master device.

Output Requirements

The Ping Response message is transmitted to the master device.

Slave Device Port Identification Function

Input Requirements

The Slave Device Port Identification Function receives messages from the Inbound Bus Management Redirect Function when the BUSMGMT bit in the message flag bit is set and the message represents a Port Identification Request Message.

These messages are received at the broadcast address.

Processing Requirements

Upon receipt of a Port Identification Request Message, the function queries the state of the PIP pin on the CCB connector.

Output Requirements

If PIP is asserted, a Port Identification Response Message is assembled and returned to the master device.

If PIP is de-asserted, no further action is taken.

Bus Management Protocol Definition

Bus Management Address Acquisition Protocol

Figure F-17 depicts the format for a slave Address Acquisition Request message.

Sadd	Dadd	Flag	Tag	Len	Cmd						
0xFE	0x00	0x01	0xnn	N	0x00	D_0	D_1	.	.	.	D_N

Figure F-17. Slave Address Acquisition Request

Since the slave device only needs to acquire an address when using the temporary slave address of 0xFE, the source address is set to that value.

The destination address is always 0 for the master device.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The Length byte includes one byte for the command byte and the length of the device serial number string, including the null string terminator character.

The command byte of 0x00 indicates an Address Acquisition Request.

The slave device serial number, programmed into the device at time of manufacture, is included as data. The serial number is formatted as a null terminated text string. The serial number string and terminating null character is appended to the four-byte message header and command byte to form the complete message.

Master Device Address Assignment Response

Figure F-18 depicts the format of an Address Assignment message sent from the master to a specific slave device.

Sadd	Dadd	Flag	Tag	Len	Cmd	New						
0x00	0xFE	0x01	0xnn	N	0x80	Addr	D_0	D_1	.	.	.	D_N

Figure F-18. Master Address Assignment Response

The source address of 0 represents the fixed address of the master device.

The destination address of 0xFE represents the temporary address of slave devices that have not yet been assigned a unique bus address.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The Len of N includes one byte for the Command byte, one byte for the newly assigned address, the length of the serial number string for the targeted slave device, and the terminating null of the string.

Appended to the four-byte message header is one command byte with value set to 0x80 representing an Address Assignment message, one byte which is the new address assigned to the slave device, the serial number string of the slave device, and the null string terminator.

When a slave receives this message, it compares the received serial number to its serial number and, if the serial number strings match, it sets its local device address to be equal to the new address sent in the received message packet.

Bus Management Ping Protocol

Master Ping Request

Ping requests sent by the master are formatted as shown in Figure F-19.

Sadd	Dadd	Flag	Tag	Len	Cmd
0x00	0xN	0x01	0xnn	1	0x81

Figure F-19. Master Ping Request

Source address of 0x00 represents the fixed master address.

Destination address is set to the unique address that is assigned to the slave device.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x81 is the ping command.

Slave Ping Response

Ping responses sent by slave devices are formatted as shown in Figure F-20.

Sadd	Dadd	Flag	Tag	Len	Cmd	D_0	D_1	.	.	.	D_N
0xN	0x00	0x01	0xnn	N	0x01						

Figure F-20. Slave Ping Request

Source address of 0xN represents the unique assigned address of the slave device.

Destination address is set to the 0x00, the fixed address of the master device.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of N accommodates the single command byte and the length of the device serial number string, including null terminator.

The command byte of 0x01 is the ping response.

The unique device serial number string—including the null string terminator—is appended to the response message.

Bus Management Bus Reset Message

Master Bus Reset

Bus Reset requests sent by the master are formatted as shown in Figure F-21.

Sadd	Dadd	Flag	Tag	Len	Cmd
0x00	0xFF	0x01	0xnn	1	0x84

Figure F-21. Master Bus Reset

Source address of 0x00 represents the fixed master address.

Destination address is set to the broadcast address of 0xFF for reception by all slave devices.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x84 is the Bus Reset command.

Bus Management Port Identification Protocol

Master Port Identification Request

Port identification requests sent by the master are formatted as shown in Figure F-22.

Sadd	Dadd	Flag	Tag	Len	Cmd
0x00	0xFF	0x01	0xnn	1	0x85

Figure F-22. Master Port Identification Request

Source address of 0x00 represents the fixed master address.

Destination address is set to the broadcast address that is received by all slave devices.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x85 is the Port Identification Request.

Slave Port Identification Response

When the port identification pin on the slave device is asserted, the device assembles and responds with a port identification response as shown in Figure F-23.

Dadd	Flag	Tag	Len	Cmd	D_0	D_1	.	.	.	D_N
0x00	0x01	0xnn	N	0x02						

Figure F-23. Slave Port Identification Response

Source address of 0xN represents the unique assigned address of the slave device.

Destination address is set to the 0x00, the fixed address of the master device.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of N accommodates the single command byte and the length of the device serial number string including null terminator.

The command byte of 0x02 is the port identification response.

The unique device serial number string including the null string terminator is appended to the response message.

Bus Management Client Event Messages

Slave Device Connection Message

Each time a slave device is assigned an address the master device queues a message for its client application to indicate the event. The message is formatted as shown in Figure F-24.

Sadd	Dadd	Flag	Tag	Len	Cmd
0xN	0x00	0x01	0xnn	1	0x82

Figure F-24. Slave Device Connection Message

The source address is the assigned address of the newly connected slave device.

The destination address is always zero.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x82 indicates that this is a connection event.

The message indicates to the client application that slave device 0xN has been newly connected to the bus and is ready for operation.

Slave Device Disconnection Message

Each time the CCB stack on the master determines that a slave device is no longer responding on the bus, master device queues a message for its client application to indicate the event. The message is formatted as shown in Figure F-25.

Sadd	Dadd	Flag	Tag	Len	Cmd
0xN	0x00	0x01	0xnn	1	0x83

Figure F-25. Slave Device Disconnection Message

The source address is the address of the now disconnected slave device.

The destination address is always zero.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x83 indicates that this is a disconnect event.

The message indicates to the client application that slave device 0xN has been disconnected from the bus.

Slave Device “ACK” Response Message

The slave has the option of sending a general 'ACK' response when it received a message but only when there's no other specific response. The message is formatted as shown in Figure F-26.

Sadd	Dadd	Flag	Tag	Len	Cmd
0xN	0x00	0x01	0xnn	1	0x03

Figure F-26. Slave Device “ACK” Message

The source address is the assigned address of the slave device.

The destination address is always zero.

The BUSMGMT bit of the Message Flags byte is set to indicate a bus management message.

The length value of 1 accommodates the single command byte.

The command byte of 0x03 indicates that this is an acknowledgment event.

Bus Management Command Summary

Table F-7 lists the commands for Bus Management.

Table F-7. Bus Management Commands

COMMAND BYTE	SOURCE	FUNCTION
0x00	Slave	Address Acquisition Request
0x01	Slave	Ping Response
0x02	Slave	Port Identification Response
0x03	Slave	Acknowledgment to message
0x80	Master	Address Assignment Command
0x81	Master	Ping Request
0x82	Master	Slave Connection Message
0x83	Master	Slave Disconnection Message
0x84	Master	Bus Reset Message
0x85	Master	Port Identification Request

Applicable Documents

- TIA-485-A Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems (ANSI/TIA/EIA-485-A-98) (R2003)
- TSB-89-A: Application Guidelines for TIA/EIA-485-A
- *Serial Port Complete: COM Ports, USB Virtual COM Ports, and Ports for Embedded Systems, Second Edition (Complete Guides series)* (Paperback) by Jan Axelson
- *RS485 Cables - Why you need 3 wires for 2 (two) wire RS485* (http://www.chipkin.com/articles/rs485-cables-why-you-need-3-wires-for-2-two-wire-rs485)
- *Guidelines for Proper Wiring of an RS-485 (TIA/EIA-485-A) Network* (http://www.maxim-ic.com/appnotes.cfm?appnote_number=763&CMP=WP-1)

APPENDIX G: 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 G-1 shows the dew point.

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

Table G-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
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.

APPENDIX H: OBIS METAMORPH DRIVER SET-UP

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

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).

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.

Install the Coherent MM Configuration Program

To install the Coherent MM Configuration program:

1. To download the *OBIS MetaMorph Driver* zipped file to a PC, contact Coherent Technical Support or go to:

   `https://cohrstage.coherent.com/assets/software/OBIS_MetaMorph_Driver_v1.0.4.9_beta.zip`

   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.

Install the Meta Imaging Series Software

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

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 H-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.

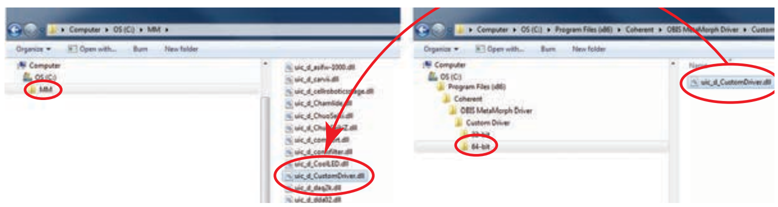


Figure H-1. Location of the Device Driver Files

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 H-2:

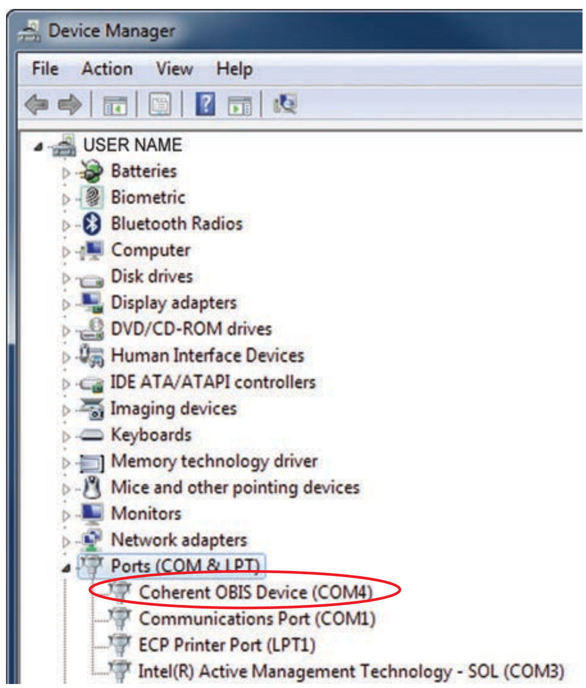


Figure H-2. Verify Device Connected

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

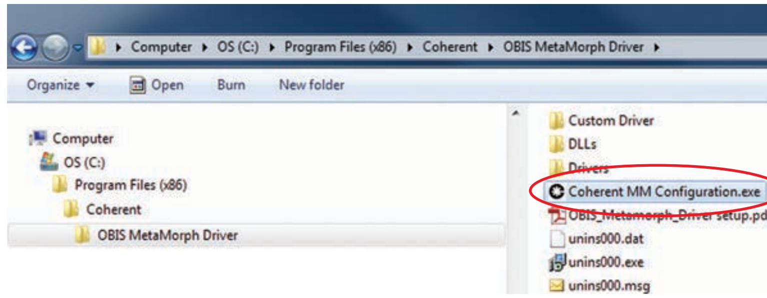


Figure H-3. Start Configuration Program

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 H-4.

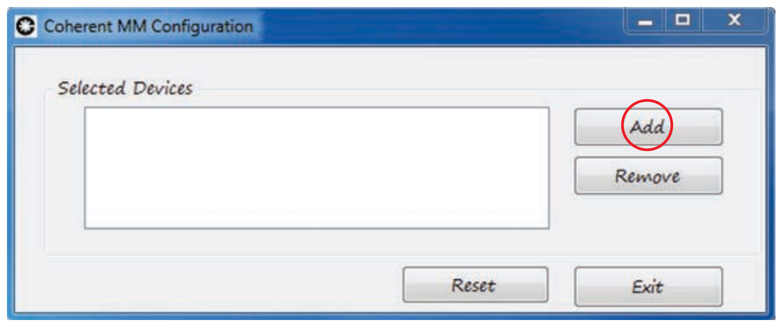


Figure H-4. Add Button

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 H-5.

Figure H-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 H-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**.

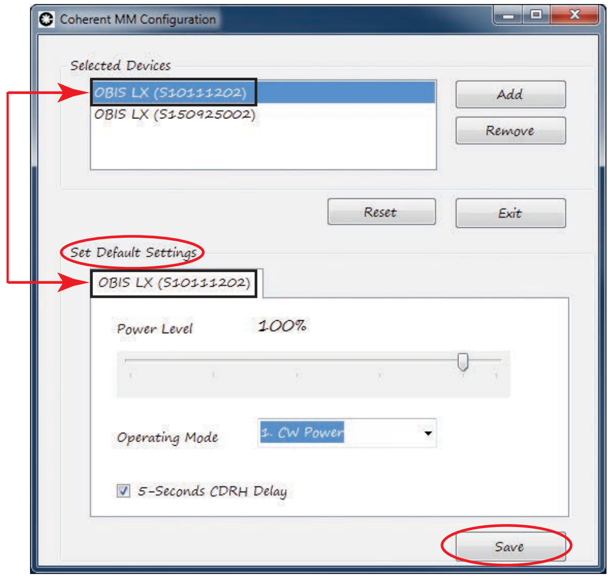


Figure H-6. Two OBIS Lasers Connected

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.

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.

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.

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

Table H-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
6	Mixed Power	Mixed:Power	Alternative mixed modulation	MIXSO
7	Mixed Modulation	Mixed:Current	Mixed analog and digital modulation	MIXED

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

Table H-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

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

OPERATING MODE #	PER CONFIG PROGRAM	OBIS LS LASERS	DESCRIPTION	SCPI
3	Analog Power	Analog Modulation	Analog modulation	ANALOG
4	Mixed Current	Mixed Modulation	Mixed analog and digital modulation	MIXED

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

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

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

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

Table H-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

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 H-7:

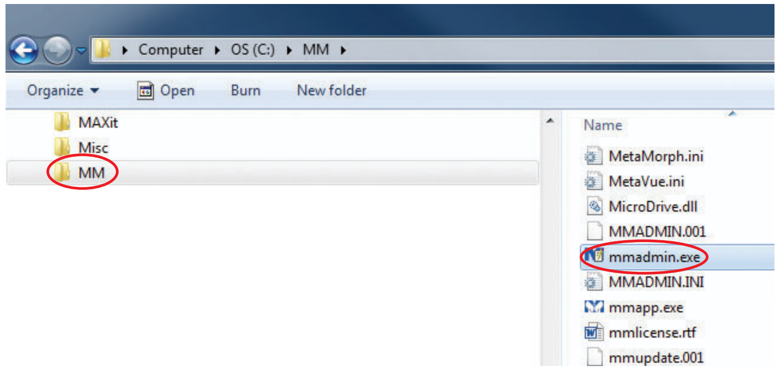


Figure H-7. Run the .exe File

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

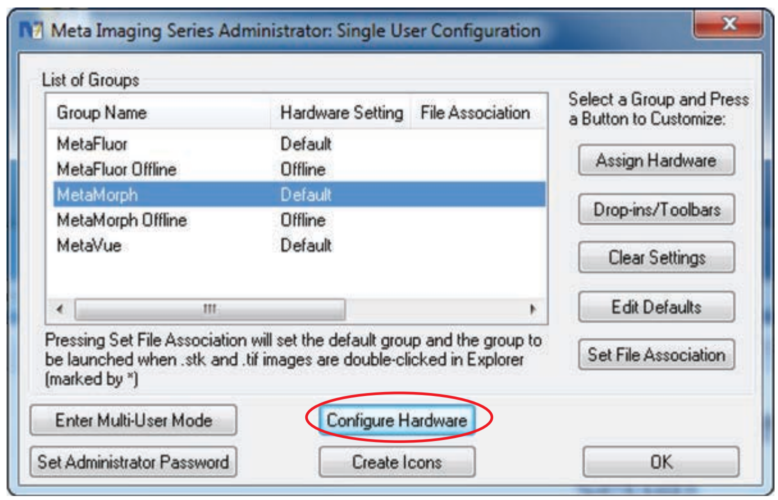


Figure H-8. Configure Hardware Button

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

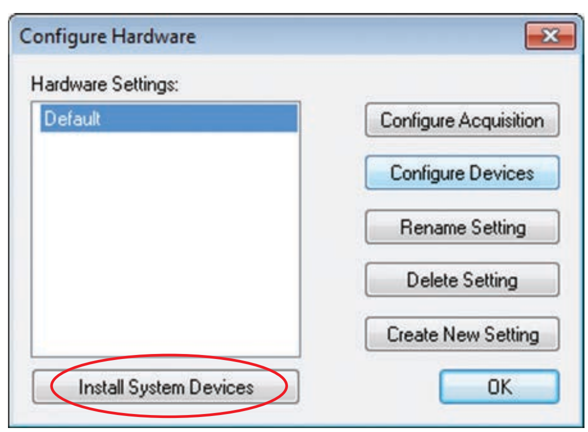


Figure H-9. Install System Devices

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

IMPORTANT!
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.

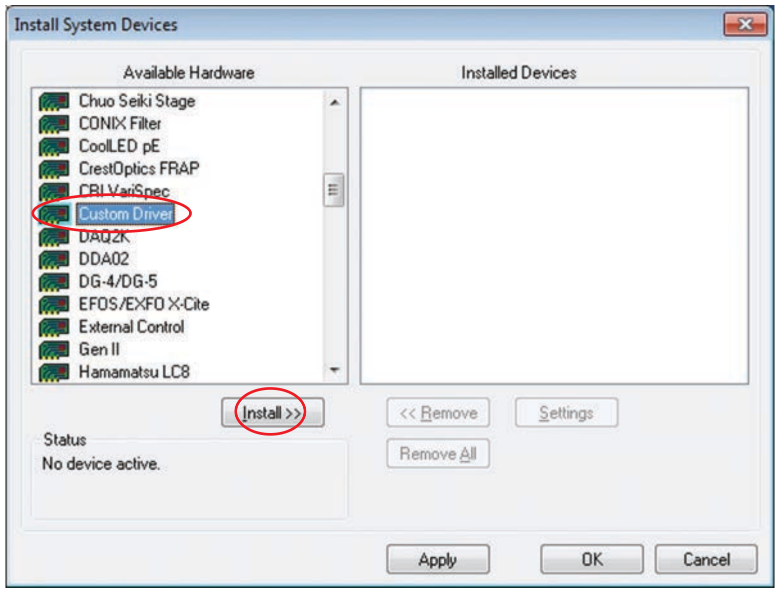


Figure H-10. Install Custom Driver

6. When the error message shown in Figure H-11 is displayed, click **OK**.

Figure H-11. Error Message

7. Click the directory for **Custom Driver** in the right column, and then click **Settings,** as shown in Figure H-12.

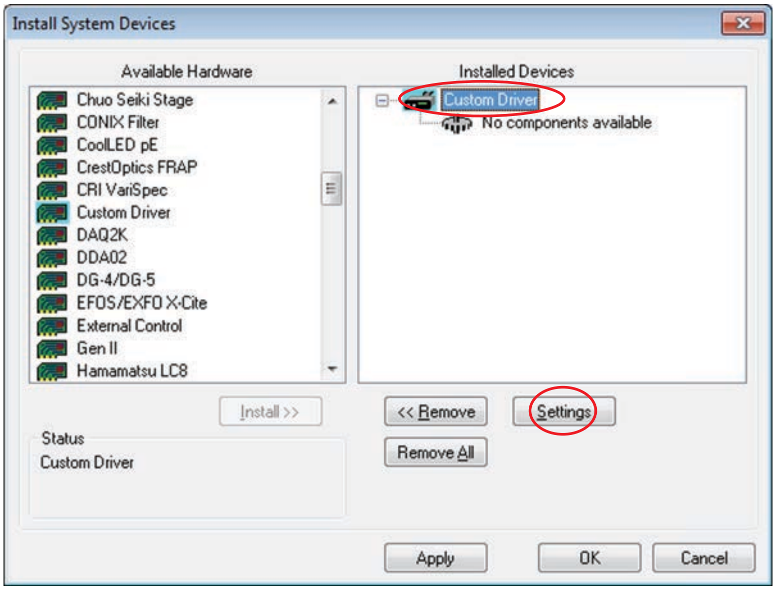


Figure H-12. Apply Settings to the Custom Driver

8. Click the **Browse for DLL file** button, as shown in Figure H-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.

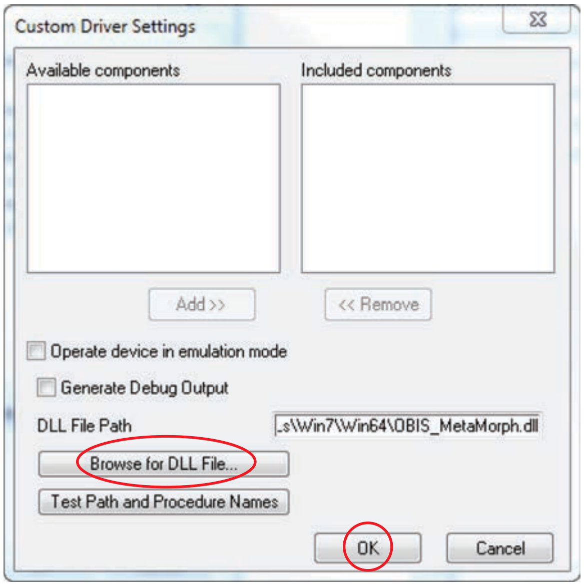


Figure H-13. Browse for DLL File

9. After the DLL file path is entered, click **OK**.

   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 H-14, click **Apply** and then **OK**.

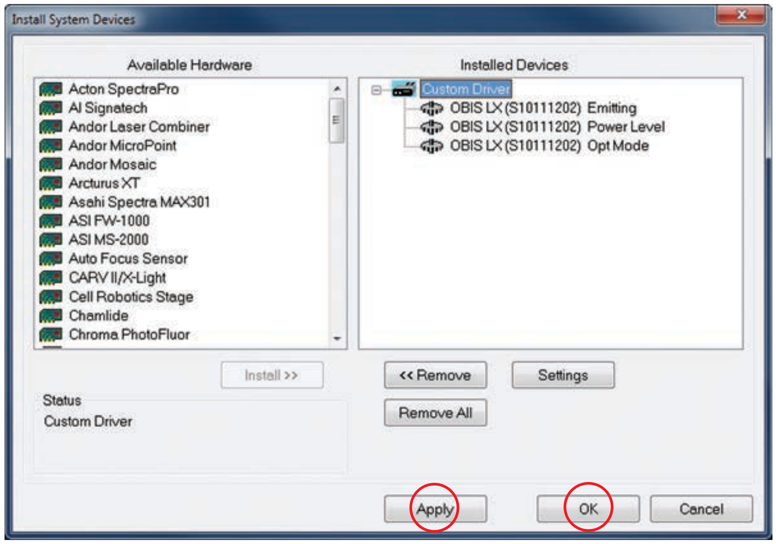


Figure H-14. Apply Custom Driver

11. In Configure Hardware (Figure H-15), click **Configure Devices**.

Figure H-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 H-16.

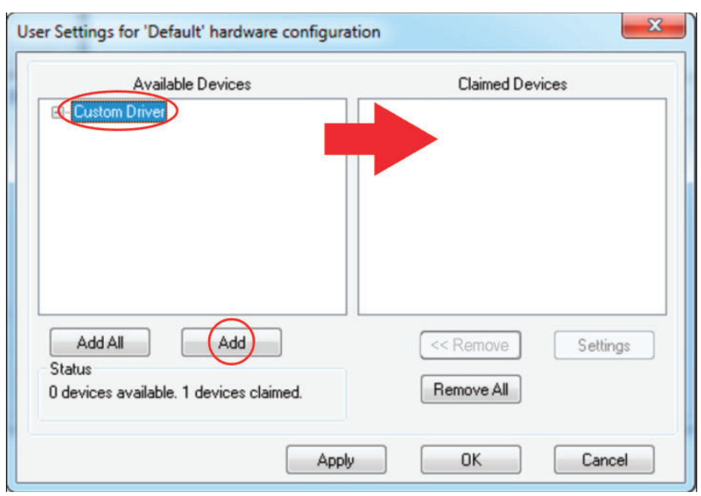


Figure H-16. Add Custom Driver to Devices

13. Click **Apply**, then **OK** to save these settings, as shown in Figure H-17.

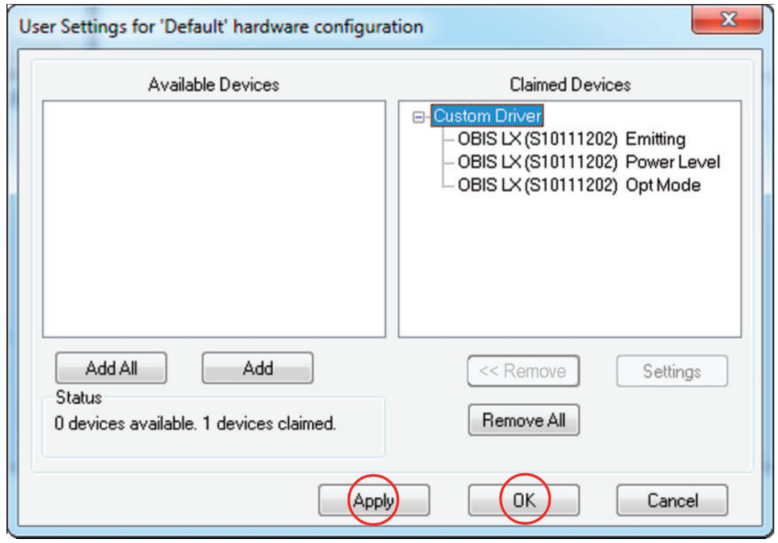


Figure H-17. Save Settings

14. Click **OK** again to close the Configure Hardware window, shown in Figure H-18.

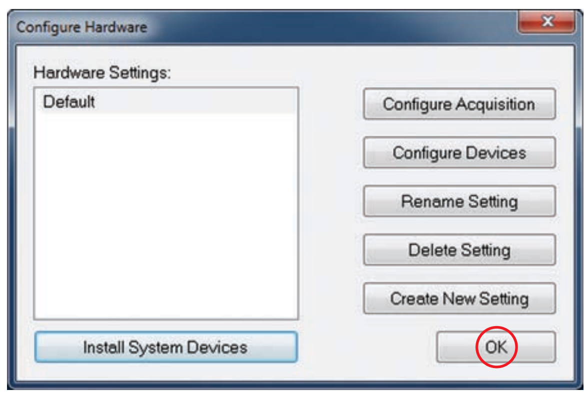


Figure H-18. Close Configure Hardware Window

15. Click **OK** to close the Meta Imaging Series Administrator program, shown in Figure H-19.

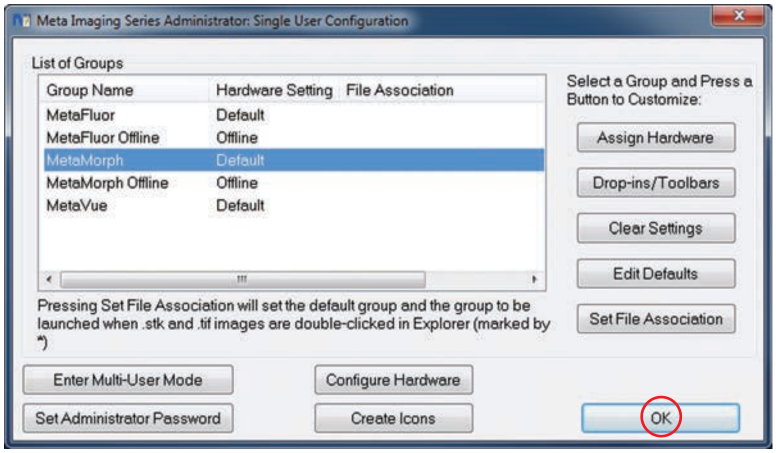


Figure H-19. Close the Program

NOTE:
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.

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 H-20.

3. From the Devices drop-down menu, select “Configure Illumination” as shown in Figure H-21.

The window shown in Figure H-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. H-5).
- “Emitting” displays the current emission state of the laser.

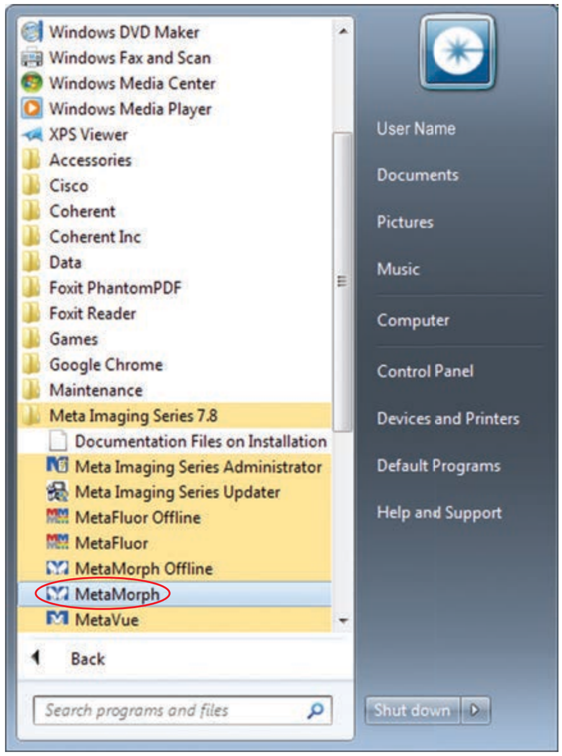


Figure H-20. Run MetaMorph in the Windows Start Panel

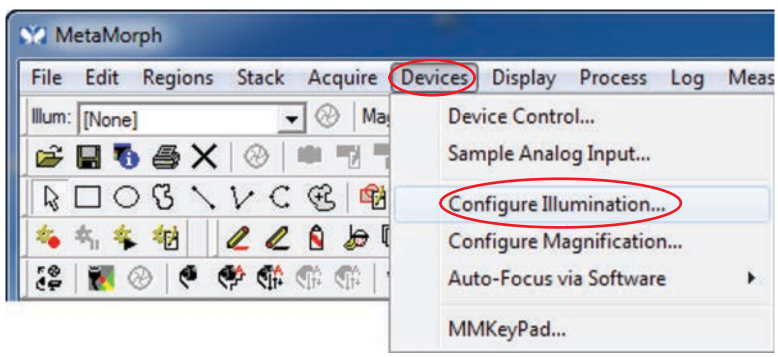


Figure H-21. Configure Illumination Menu Option

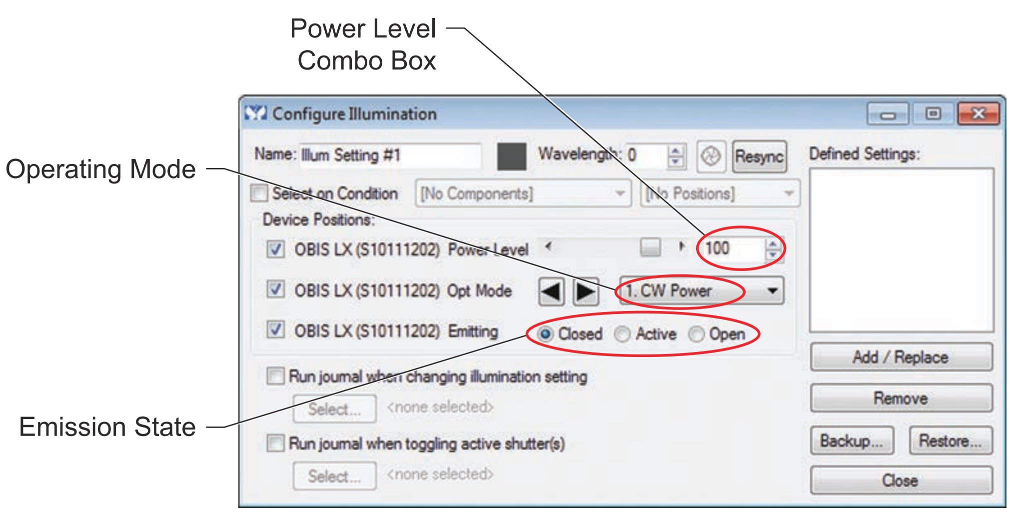


Figure H-22. Settings for Configure Illumination

4. Adjust the parameters (as needed), and click the **Add / Replace** button shown in Figure H-23 to define the new settings.

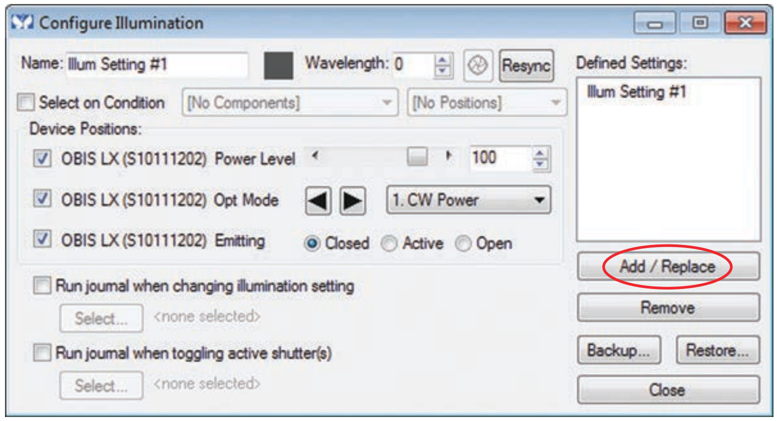


Figure H-23. Define New Settings

5. Click the **Close** button shown in Figure H-24 to exit the Configure Illumination window.

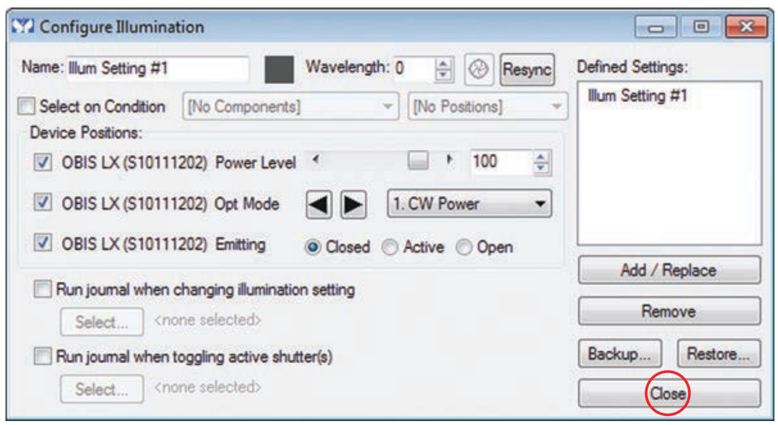


Figure H-24. Close Configure Illumination Settings

6. Click the "X" to separately close the MetaMorph program, as shown in Figure H-25.

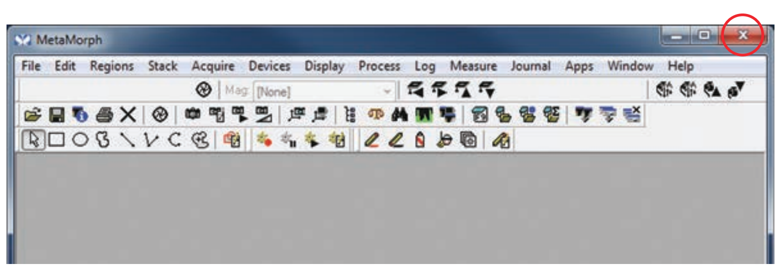


Figure H-25. Close the MetaMorph Program

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/

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 p. B-1 for methods of contact.

Appendix I: Beam Propagation

In this section:

- Beam diameter (this page)
- M^2 (M squared) factor (p. I-2)
- Beam propagation (p. I-2)
- Focusing a beam (p. I-3)
- Rayleigh range and depth of focus (p. I-3)
- Beam expansion (p. I-4)

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 D: Back Reflection" (p. D-1) for additional precautions and safety instructions.

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 I-1 is illustrated for an ideal case.

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.

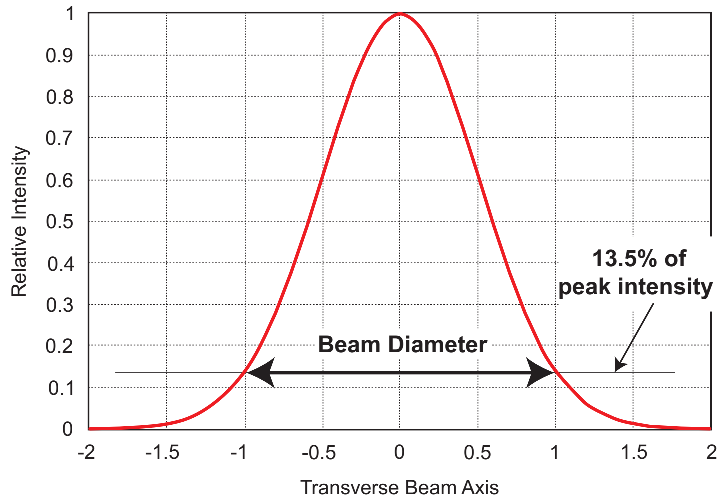


Figure I-1. Gaussian Beam Profile

M^2 (M Squared) Factor

The actual laser beams differ somewhat from the ideal Gaussian profile shown in Figure I-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.

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:

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

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

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:

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

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

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.

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 I-2.

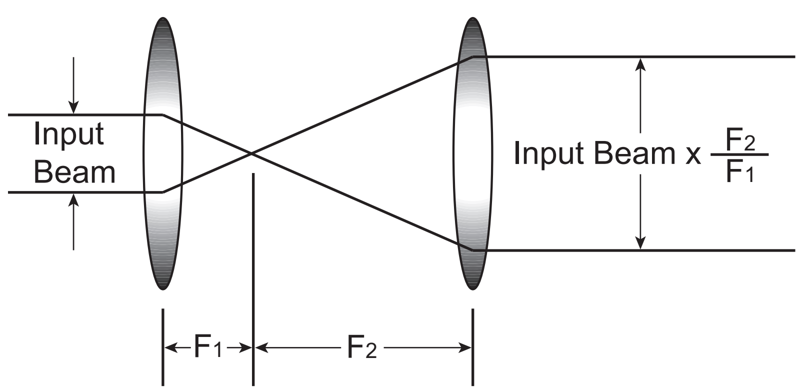


Figure I-2. Simple Beam Expander

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 I-3 shows the combination of a 2.5-inch and 5-inch lenses to magnify the beam by a factor of two.

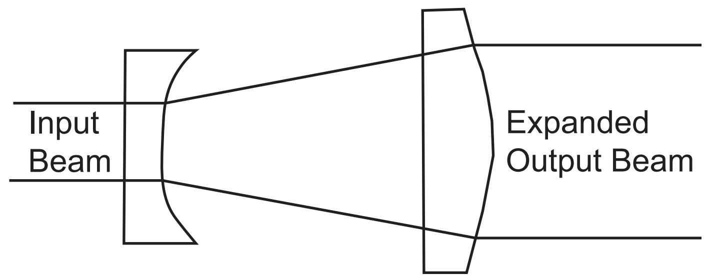


Figure I-3. Galilean Beam Expander

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.

APPENDIX J: POWER MEASUREMENT INSTRUMENTATION

OBIS Power Meter Instrumentation

Coherent offers a wide variety of instruments for laser test and measurement. For detailed information about these products, contact your Coherent sales representative, or visit the Coherent website at:

https://www.coherent.com/measurement-control/

For the most common diagnostics need—measuring the output power of the OBIS—we recommend two different types of power meters that are ideal fits to the OBIS product family.

First Recommendation

Coherent offers a product combination that covers that entire wavelength range at these power levels.

The PS10, shown in Figure J-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 J-1. Power Measurement: PS10 Sensor and Adapter

Coherent recommends the FieldMaxII-TOP, shown in Figure J-2, to work with the PS10 sensor.

FieldMaxII-TOP Laser Power and Energy Meter (RoHS), P/N 1098580

Figure J-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.

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 J-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 J-3. Power Measurement: LaserCheck

NOTE: LaserCheck does not measure below 400 nm, so this device is not recommended for the OBIS 375 laser.

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 J-4 shows the PowerMax-USB Quantum Power Sensor.

PowerMax-USB UV/VIS Quantum Power Sensor (RoHS), P/N 1168337

Figure J-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.

APPENDIX K: SDR-SMB MODULATION ADAPTER

The OBIS SDR-to-SMB Modulation Adapter is designed for convenient access to the digital and Analog Modulation inputs of the OBIS laser. This Adapter converts single-ended modulation inputs to the LVDS voltage levels that the OBIS requires for modulation.

This section describes the features of the OBIS SDR-to-SMB Modulation Adapter, as well as provides instructions to set up and use the Adapter.

Features

Figure K-1 provides an overview of the OBIS SDR-to-SMB Modulation Adapter and its connectors:

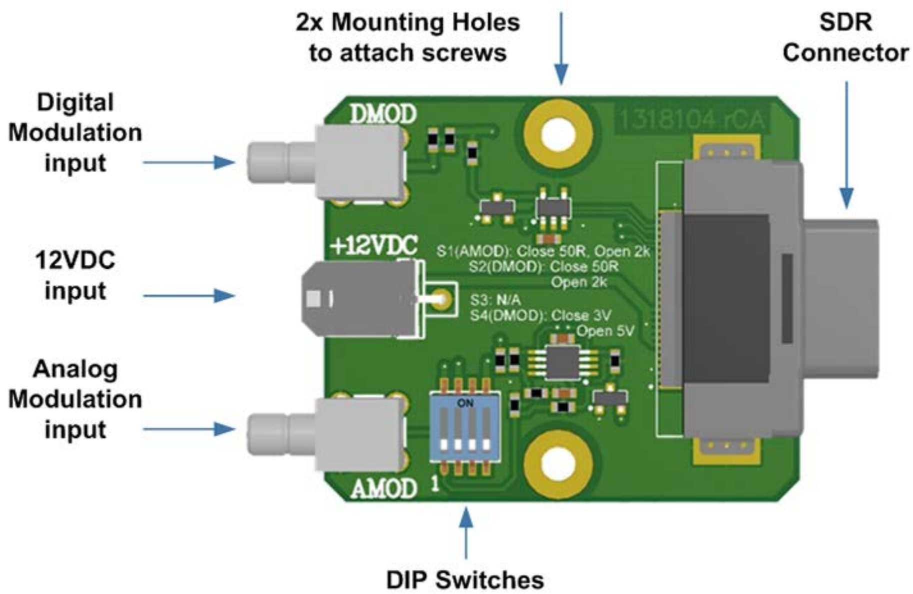


Figure K-1. The OBIS SDR-to-SMB Modulation Adapter

The OBIS SDR-to-SMB Modulation Adapter features include:

- 12VDC power input that supplies power to both the Adapter and the laser using a standard OBIS power supply (see p. 2-19)
- Single-ended Digital Modulation input
  - Input impedance 2kΩ or 50Ω
  - Input range 0V-5V or 0V-3.3V
  - Impedance and voltage range selectable by a DIP switch
- Single-ended Analog Modulation input
  - Input impedance 2kΩ or 50Ω
  - Input range 0V-5V for minimum (**`min_Power`**) to maximum (**`max_Power`**) analog output power control
  - Impedance selectable by a DIP switch
- USB and fan connector accessible through the back panel of the OBIS laser

- SDR connector to directly plugs the Adapter into the OBIS laser (no separate SDR cable required)

The OBIS SDR-to-SMB Modulation Adapter is shipped as a Kit (P/N 1319290) with screws and a plastic tray to allow for easy mounting. (See "Ordering Information" on page 7.)

Functional Description

This section describes various functions of the OBIS SDR-to-SMB Modulation Adapter.

Power

Power to the Adapter is supplied through the 12VDC input connector on the board. This 12VDC connector supplies power through the SDR connector to both the Modulation Adapter and the OBIS laser that are connected.

The Adapter does not need a separate DC supply. Instead of powering the OBIS laser via the back panel, the DC supply connects directly into the Adapter.

The USB terminal and the fan supply outlet on the back panel of the OBIS Laser are still available.

CAUTION:
Do not add a second power connector to the OBIS laser. All power is provided through the Modulation Adapter.

For additional information, see "Electrical Set-Up" (p. K-5).

Digital Modulation

The OBIS SDR-to-SMB Modulation Adapter provides a single-ended SMB input for Digital Modulation. The circuit on the board converts the modulation input signal into the differential LVDS signal used by the OBIS laser. Due to the pull-down resistor, laser emission goes to the OFF state when Digital Modulation is activated and the modulation input connector is not connected.

The input impedance and the voltage range of the Digital Modulation input connector can be selected by the DIP switch; see "DIP Switches" (p. K-3).

Analog Modulation

The OBIS SDR-to-SMB Modulation Adapter provides a single-ended SMB input for Analog Modulation. The circuit on the board converts the modulation input signal into the differential LVDS signal used by the OBIS laser. Due to the pull-down resistor, the power goes to minimum output power when Analog Modulation is activated and the modulation input connector is not connected.

The input voltage range of the Analog Modulation input is:

0V to 5V = represents minimum to maximum output power

The input impedance of the Analog Modulation input connector can be selected by the DIP switch; see “DIP Switches” (p. K-3).

DIP Switches

The DIP switches on the OBIS SDR-to-SMB Modulation Adapter allow you to set the input impedance of both modulation inputs and the voltage range of the Digital Modulation input.

Table K-1 lists the selections available using the DIP switches:

Table K-1. DIP Switches on the SDR-to-SMB Modulation Adapter

SWITCH	DESCRIPTION AND SETTINGS
S1	Selects input impedance for Analog Modulation input. The default setting is 2kΩ. • ON = 50Ω • OFF = 2kΩ
S2	Selects input impedance for Digital Modulation input. The default setting is 2kΩ. • ON = 50Ω • OFF = 2kΩ
S3	Reserved.
S4	Selects the input voltage range for the Digital Modulation input. Supports different TTL logic levels. The default setting is 0V/5V. • ON = Digital Modulation input is 0V/3.3V. • OFF = Digital Modulation input is 0V/5V.

SDR Connector

The SDR Connector plugs directly into the back panel of the OBIS laser. No head cable is required.

The connector is locked in place by mounting the OBIS SDR-to-SMB Modulation Adapter with the two screws and the plastic tray. See instructions in “Mechanical Set-Up” (p. K-4) about how to secure the position of the SDR connection between the Modulation Adapter and the OBIS laser.

Mechanical Dimensions

All dimensions are stated in both metric (mm) and standard (inches).

Figure K-2 shows the dimensions for the OBIS SDR-to-SMB Modulation Adapter when attached to a laser, from a top view:

Figure K-3 shows the dimensions for the OBIS SDR-to-SMB Modulation Adapter when attached to a laser, from a side view:

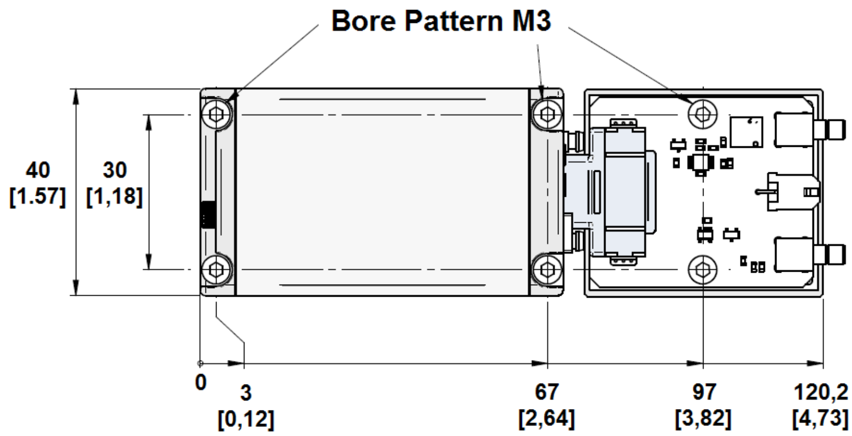


Figure K-2. Adapter Dimensions—Top View

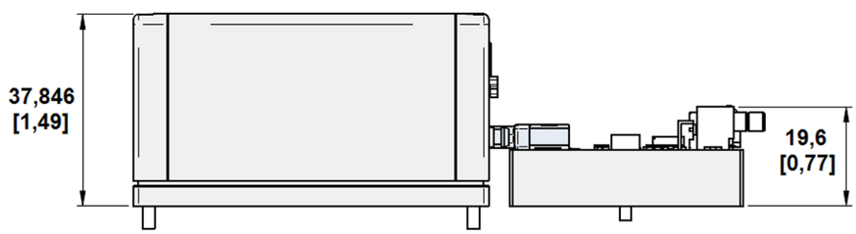


Figure K-3. Adapter Dimensions—Side View

Installation

This section describes the procedures for both mechanical and electrical set-up to attach the OBIS SDR-to-SMB Modulation Adapter to an OBIS laser.

Note the precautions about laser safety and appropriate procedures in other applicable sections in this manual.

Mechanical Set-Up

To physically connect the OBIS SDR-to-SMB Modulation Adapter to an OBIS laser:

1. If the OBIS laser is not already attached to a heat sink, set that up now. See "Step 2: Mount the Laser" (p. 3-4) for detailed instructions.

IMPORTANT!
Never use a thermal grease or compound between the OBIS laser and the heat sink. ***The use of such materials voids the Coherent warranty!***

2. Tighten the M3x35 mm screws in the laser in a diagonal pattern shown in Figure 3-9 on page 3-6. 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.) Avoid using excessive force.

3. Insert the OBIS SDR-to-SMB Modulation Adapter PCB into the plastic tray to support the circuit board.
4. Attach the Adapter PCB to the tray using the two (2) M3 screws shipped with the Kit.
5. Align the SDR connector for the assembled Adapter with its SDR connector facing the SDR connector on the back panel of the OBIS laser.
6. Gently insert the SDR connector on the Adapter until it solidly connects with the mating SDR connector on the back of the OBIS laser.

IMPORTANT NOTE!
Pins in the SDR connector on the Adapter can be shorted if the pins are inserted at an angle with the SDR mating connector. Use care when aligning the connecting parts.

7. Secure the Adapter to the laser using the M3x14 screws supplied in the Adapter Kit.

When finished, the set-up should look like the image shown in Figure K-4:

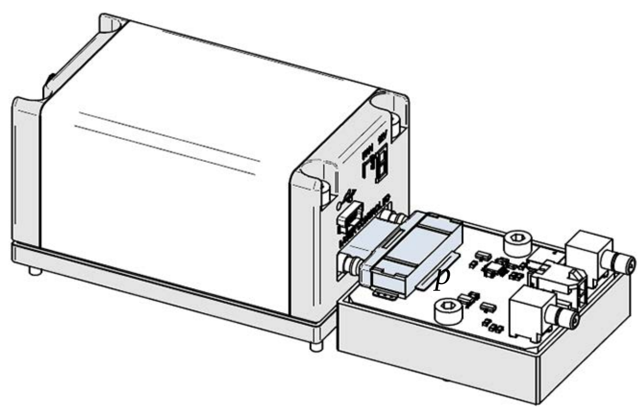


Figure K-4. Adapter Attached to the Laser

Electrical Set-Up

This section describes how to set up the electrical connection between the OBIS SDR-to-SMB Modulation Adapter and the OBIS laser.

1. Set the DIP switches to the input impedances and input voltage range. In many cases, the jumpers can be left in the default "OFF" connection.

   For the explanation about DIP switch positions, see"DIP Switches" (p. K-3).
2. Plug in the required modulation input connectors. If a connector is not used, it does not need to be connected.
3. Connect 12VDC to the 12V power connector at the Modulation Adapter.

CAUTION:
Do not plug another 12V connector into the OBIS laser. All DC power is provided through the Modulation Adapter.

Connecting another 12V power source into the OBIS laser back panel while the OBIS SDR-to-SMB Modulation Adapter is already connected to the OBIS may cause damage to both the laser and the Modulation Adapter. Such a connection may also defeat safe disabling of the 12V power supply line on the OBIS SDR-to-SMB Modulation Adapter.

If the modulation mode has not yet been selected, you must also connect the laser to a host workstation and install Coherent Connection software.

Select Modulation Mode

Through the USB connection and software control, a user can select the desired modulation mode (digital | analog | mixed mode)—see “Select Modulation Mode” (p. K-6). After it is set, the modulation mode is stored in non-volatile memory. This connection is mandatory to initially set a modulation mode for the laser.

By default, the laser operates in Continuous Wave with constant Power (CWP) mode, with the modulation inputs disabled.

After the modulation mode is set, the setting is stored in a non-volatile memory.

CAUTION: Remember to take all necessary precautions and follow warning messages in this manual when working with laser emission.

To enable the desired modulation input, the correct modulation mode must first be selected. To do so:

1. Establish the electrical connection to the host computer by connecting a mini-USB cable from the back panel of the OBIS laser.
2. Install the Coherent Connection software on the host workstation.
3. Run the software and ensure that it displays the OBIS laser.

   For details about using Coherent Connection with additional explanation of its features, see “Section Five: Coherent Connection” (p. 5-1) Section Five, “Coherent Connection”.

   If you prefer to use terminal commands, see “OBIS Communications through a Terminal Program” (p. 6-5).
4. Make sure that laser emission is not activated. If the laser begins emitting, press the “Stop” button in the main window of the software.
5. Go to the “Advanced” tab.
6. In the drop-down menu for “Operating Mode”, select the desired modulation mode. The modulation mode is stored in a non-volatile memory, and the OBIS laser automatically starts in the selected modulation mode after the next DC power cycle.

For descriptions about each of these modes, see“Modulation Modes” (p. 4-6).

7. To begin laser light emission, press the “Start” button in the software or send an equivalent command via a terminal interface.

If you want to activate the Auto Start function, first stop laser emission, then go to the “Advanced” tab and click the check box in the software. For instructions, see “Enable Auto Start Using the OBIS Remote” (p. 6-2).

Compliance

To comply with the China RoHS (Restriction of Hazardous Substances) Directive, any hazardous substances found in the OBIS SDR-to-SMB Modulation Adapter are identified.

The example shown in Figure K-5 lists Lead (Pb), as well as the environmental-friendly use period of 20 years (as indicated by the number “20” inside the circle).

Figure K-5. Adapter Label for China RoHS

Ordering Information

The OBIS SDR-to-SMB Adapter Kit (P/N 1319290) includes the parts listed in Table K-2:

Table K-2. Parts in the SDR-to-SMB Adapter Kit

QUANTITY	DESCRIPTION
1	PCBA, OBIS-SMB-SDR Adapter, DIP-switch version
1	Plastic tray for circuit board support
2	M3x14 Cap Screw, Socket head, hex drive

Contact Coherent as follows to order this Adapter or any OBIS laser, tools, or accessories.

- Call Coherent Technical Support Hotline at 1.800.367.7890 (or, outside of the USA, call 1.408.764.4557).
- Send an email to Product.Support@Coherent.com.
- Contact your local Coherent service representative; see www.Coherent.com for a list of contacts worldwide.

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—see Table F-6 (p. F-9)
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—see Table F-6 (p. F-9)
SRCCONT	Message originated from master device (controller)—see Table F-6 (p. F-9)
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)

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Superior Reliability & Performance

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OBIS® LS/LX Lasers — *Operator's Manual*

Part No. 1184163 Rev. AH