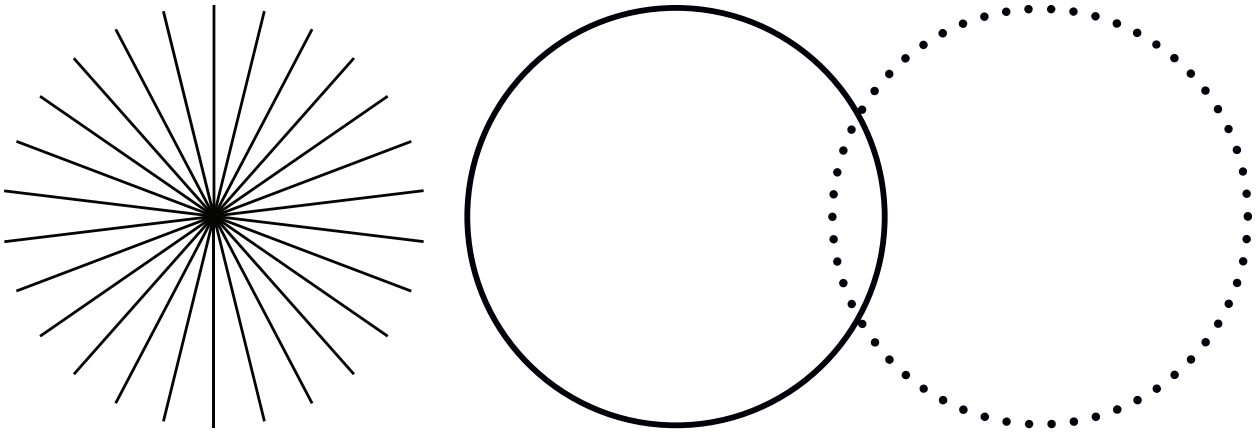
OBIS LG
Laser Systems

Integrator's Manual



INNOVATIONS THAT RESONATE

COHERENT

Integrator's Manual
OBIS LG Laser Systems

COHERENT

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Santa Clara, CA 95054

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Should you experience any difficulties with your laser or need any technical information, please go to our web site **www.Coherent.com**. Should you need further assistance, please contact Coherent Technical Support by e-mail **customer.support@coherent.com** or telephone, 1-800-367-7890 (1-408-764-4557 outside the U.S.). Please be prepared to supply the model and laser head serial number of your laser system, the description of the problem, and any attempted corrective steps to the Product Support Engineer responding to your request.

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

Outside the U.S.:

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Table of Contents

List of Illustrations

List of Tables

1 Introduction

1.1 Signal Words and Symbols in this Manual

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

1.1.1 Signal Words

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

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

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.

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

NOTICE
Indicates information considered important, but not hazard- related.

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

1.1.2 Symbols

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

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

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

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

This symbol is intended to alert the operator to the presence of dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

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

This symbol is intended to alert the operator to the danger of crushing injury.

This symbol is intended to alert the operator to the danger of a lifting hazard.

1.2 Preface

This manual contains user information for the OBIS LG.

NOTICE
Read this manual carefully before operating the laser for the first time. Failure to follow the instructions and safety precautions in this manual can result in serious injury or death. Special attention must be given to the material in "Laser Safety" (p. 7), that describes the safety features built into the laser. Keep this manual with the product and in a safe location for future reference.

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

1.3 Export Control Laws Compliance

It is the policy of Coherent to comply strictly with U.S. export control laws.

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.

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 U.S. law, clarification must be obtained from Coherent or an appropriate U.S. Government agency.

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.

1.4 The Operator's Manual

This Operator Manual is designed to familiarize the user with the OBIS LG system and its designated use. It contains important information on how to install, operate, and troubleshoot the laser system safely, properly, and most efficiently. Observing these instructions helps to avoid danger, reduce repair costs, and downtimes and increase the reliability and lifetime of the laser system.

This Manual:

- describes the physical hazards related to the laser system, the means of protection against these hazards, and the safety features incorporated in the design of the laser system
- briefly describes the purpose and operation as well as the primary features, system elements, subsystems, and fundamental laser control routines of the laser system
- describes the fundamental operation of the laser system
- describes the maintenance procedures for the laser system which can be performed by the end user. This includes a time schedule for all periodic routine replacement procedures and a basic troubleshooting section.

The screenshots in this manual are only examples and may show configurations or parameter settings which do not apply to the OBIS LG laser system. Changing parameter settings to correspond with screenshots may reduce laser performance or even damage the laser system!

1.4.1 Intended Audience

The Operator's Manual is intended for all persons that are to work on or with the laser system. It assumes that the reader has received guidance from their company's laser safety officer on the safe operation of the laser system.

None of the procedures described in this manual requires the defeating of safety interlocks. Where specific training is required to perform procedures, this is clearly indicated at the beginning of the corresponding section.

1.4.2 Availability and Use

This Operator's Manual must always be available wherever the laser system is in use. Keep this manual in a safe location for future reference. It must be read and applied by any person in charge of carrying out work with and on the laser system, such as

- operation (including setting up, troubleshooting in the course of work, removal of production waste, care and disposal of consumables,
- service (maintenance, inspection, repair) and/or
- transport.

1.4.3 Numbering of Sections, Pages and Instructions

The sections are numbered continuously. The name of the section appears in the upper outside corner of every odd page. Each section ends with an even page number. Consequently, certain even pages at the ends of sections will be intentionally left blank.

The pages of this manual are numbered continuously by section. The page number appears in the bottom center of every page.

Each step within a procedure is sequentially numbered. Each procedure starts with the step number one.

1.5 Units of Measurements

In this manual, units of measurement are used according to the metric system (international system of units (SI)), e.g. meter, millimeter, square meter, cubic meter, liter, kilogram, bar, pascal; and imperial system, e.g. tons, pounds, and ounces; gallons and quarts; miles, yards, feet, and inch.

Temperatures are primarily indicated in degrees celsius (°C) and fahrenheit (°F).

1.6 Feedback Regarding Documentation

If there are any comments regarding the documentation provided, please contact the Coherent Documentation Department.

In any correspondence, please provide the following:

- the document part number, revision, and date of issue,
- the section number, page number and, where applicable, the procedure step number,
- a description of any errors,
- a proposal for improvements.

1.6.1 Feedback Address

E-mail documentation.support@coherent.com

Post Coherent Inc
Documentation and Training Development Department
5100 Patrick Henry Drive
Santa Clara, CA. 95054
USA

2 Laser Safety

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

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

This laser safety section must be reviewed thoroughly prior to operating the OBIS LG system. Safety instructions presented throughout this manual must be followed carefully.

2.1 Hazards

Hazards associated with lasers generally fall into the following categories:

- Biological hazards from exposure to laser radiation that may damage the eyes or skin
- Electrical hazards generated in the laser power supply or associated circuits
- Chemical hazards resulting from contact of the laser beam with volatile or flammable substances, or released as a result of laser material processing

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

2.1.1 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 beamsplitters. 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. The user is advised to follow the control measures below.

2.1.1.1 Recommended Precautions and Guidelines

1. Observe all safety precautions in the preinstallation and operator's manuals.
2. Always wear appropriate eyewear for protection against the specific wavelengths and laser energy being generated. See "Laser Safety Eyewear" (p. 9) 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.

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.

2.1.1.2 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 (e.g. 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.

2.1.1.3 Viewing Distance

The OBIS LG produces optical power levels that are dangerous to the eyes and skin if exposed directly or indirectly. This product must be operated only with proper eye and skin protection at all times. Never view directly emitted or scattered radiation with unprotected eyes. When viewing the laser during operation, the operator must maintain the Nominal Ocular Hazard Distance (NOHD) between the laser or scatter radiation and the operator's eyes. Table 2-1 summarizes the NOHD for the power range of the OBIS LG for direct viewing of the collimated beam along with two other common configurations. The NOHD in this figure is based on the Maximum Permissible Exposure (MPE = 0.1 W/cm^2) level for each power condition as specified in ANSI Z136.1 and IEC 60825-1.

Table 2-1. Nominal Ocular Hazard Distance (NOHD) for indicated conditions calculated per IEC 60825-1

	Collimated Beam (Beam Divergence <0.2 mrad)	OD Worst Case (entire beam into eye)
OBIS LG 355-20	87 m	1.176
OBIS LG 355-50	137 m	2.114
OBIS LG 460	809 m	3.57
OBIS LG 479	809 m	3.57
OBIS LG 532	809 m	3.57
OBIS LG 561	809 m	3.57
OBIS LG 590	809 m	3.57

2.2 Electrical Safety

The OBIS LG laser does not contain hazardous voltages. Do not disassemble the enclosure. There are no user-serviceable components inside. All units are designed to be operated as assembled. Warranty will be voided if the enclosure is disassembled.

2.3 Laser Safety Requirements

This laser product is intended to be sold to an original equipment manufacturer of electronic products for use as a component (or replacement thereof) in such electronic products. As such, this product is exempt from DHHS performance standard for laser products in accordance with paragraph 1040.10(a)(1).

The following information is provided to assist the OEM in complying with radiation safety standards.

2.3.1 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 LG classification depends on the particular model. In general, UV models are classified as a CLASS 3B, visible and IR models are classified as Class 4 based on 21 CFR, Subchapter J, Part 1040, section 1040.10 (c) and/or IEC/EN 60825-1:2007, Clause 8 and IEC/EN 60825-1:2014, Clause 4. Depending on the model the OBIS LG emits visible and invisible radiation in a variety of wavelengths. See the data sheet supplied with the system or the specification sheet on the Coherent web site for classification and emission characteristics (wavelengths, power and divergence).

2.3.2 Laser Radiation Emission Indicator

A yellow indicator light is provided on the front of the laser subsystem. This light is illuminated when the laser is ready for emission or emitting. This light may not meet the IEC 60825 requirement that warning laser lights must be fail safe or redundant. The OBIS LG has been designed to accommodate a warning light that is fail safe or redundant and meets the IEC 60825 requirements. This light is part of the interlock system and must be supplied by the laser user. Refer to the description of the interlock circuit in Section Three for further details.

2.4 Backreflection

In a properly designed laser application, the laser beam exits the beam aperture and very little of the light is scattered or sent back into the laser exit aperture.

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 may result in instability, noise, and even damage to the laser.**

The amount of back reflection that can be damaging varies from system to system. Damage from back reflection can be immediate or subtle and slowly decrease the service life of the laser. A laser that shows symptoms —such as low output power, no output power, or high noise—indicates a possibility of back reflection to the laser.

To prevent damage, reduce noise, and increase the life of a laser:

- Review the objects in front of the laser and identify what 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 risk from any possible back reflections by starting the laser at lower output power—for example, <10% output power—to identify and eliminate potential hazards.
- *Using proper safety precautions*, monitor where the reflections from objects are returning to make sure the reflections are not at or near the laser exit aperture. Always use the appropriate eyewear protection.
- Take 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 does not reflect back into the laser.

- Add an optical isolator (at least 40dB isolation) in front of the laser exit aperture for applications where significant back reflections cannot be corrected, particularly when working with metal or reflective surfaces.

2.5 Environmental Compliance

2.5.1 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. Coherent is compliant with EN50581:2012 for the RoHS Directive.

2.5.2 China-RoHS Compliance

The China-RoHS Regulation restricts the use of certain hazardous substances in electrical and electronic equipment and applies to the production, sale, and import of products in the Peoples Republic of China. Refer to Figure 2-1 below for product components that are China-RoHS compliant.

2.6 EU REACH

REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) is a European Union Commission (EUC) Regulation on chemicals and their safe use (EC 1907/2006) entered into force on 01 June, 2007 and will be phased in until 2018.

Coherent products are “articles” as defined in REACH Article 3(3) and do not release substances under their normal use. Suppliers of articles must provide recipients with information on Substances of Very High Concern (SVHC) if those are present above a concentration limit of 0.1% on an article level. Coherent will communicate our continuing efforts to comply with REACH as we gather and analyze data from our supply chain. In addition, Coherent will respond to changes to the SVHC list as they are published. If SVHCs are present in Coherent products or packaging, Coherent will continue to work with our supplier base to reduce or eliminate those SVHCs from its products and packaging, and to ensure that all SVHC’s are notified to the European Chemicals Agency where practical to comply with the REACH requirements.Articles as defined by REACH regulations are exempt from registration as long as they are not intended to release a chemical substance.

Figure 2-1. China-RoHS Compliant Components

China RoHS Substance Table for Laser Heads

PN: 1323912AA	产品中有害物质的名称及含量						
部件名称 Part Name	有害物质 Hazardous Substances						
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
印刷电路板组装 Printed Circuit Board Assembly	X	O	O	O	O	O	
光学部件装配 Optic Assembly	X	O	O	O	O	O	
组装二极管激光器 Laser Diode Assembly	X	O	O	O	O	O	

本表格依据SJ/T 11364的规定编制
O: 表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
X: 表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。

China RoHS Substance Table for Power Supplies and Controllers

PN 1323913AA	产品中有害物质的名称及含量						
部件名称 Part Name	有害物质 Hazardous Substances						
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
印刷电路板组装 Printed Circuit Board Assembly	X	O	O	O	O	O	
装配电缆 Cable Assembly	X	O	O	O	O	O	
组装二极管激光器 Laser Diode Assembly	X	O	O	O	O	O	

本表格依据 SJ/T 11364 的规定编制
O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

China RoHS Substance Table for Systems Products

PN: 1324027AA	产品中有害物质的名称及含量						
部件名称 Part Name	有害物质 Hazardous Substances						
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
印刷电路板组装 Printed Circuit Board Assembly	X	O	O	O	O	O	
电缆装配 Cable Assembly	X	O	O	O	O	O	
光学部件装配 Optic Assembly	X	O	O	O	O	O	
板金组装 Sheet Metal Assembly	X	O	O	O	O	O	
组装二极管激光器 Laser Diode Assembly	X	O	O	O	O	O	

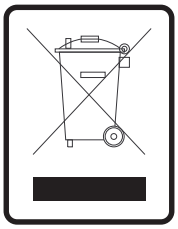
本表格依据 SJ/T 11364 的规定编制
O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

The current Candidate List of SVHCs can be found on the ECHA website https://echa.europa.eu/home

Coherent will post information on SVHCs to our website as the information becomes available and assures its customers that our products are in full compliance the EU REACH requirement. For detailed information on SVHC and Coherent products, please visit https://www.coherent.com/company/environmental

2.6.1 Waste Electrical and Electronic Equipment (WEEE, 2002)

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.



2.7 CDRH and Regulatory Compliance

The OBIS LG is not CDRH compliant. It is an OEM product designed for incorporation into other equipment. Accordingly, Coherent has provided CDRH with a supplemental report for compliance, but the user is responsible for full CDRH compliance and/or other regulatory compliance in the location of use.

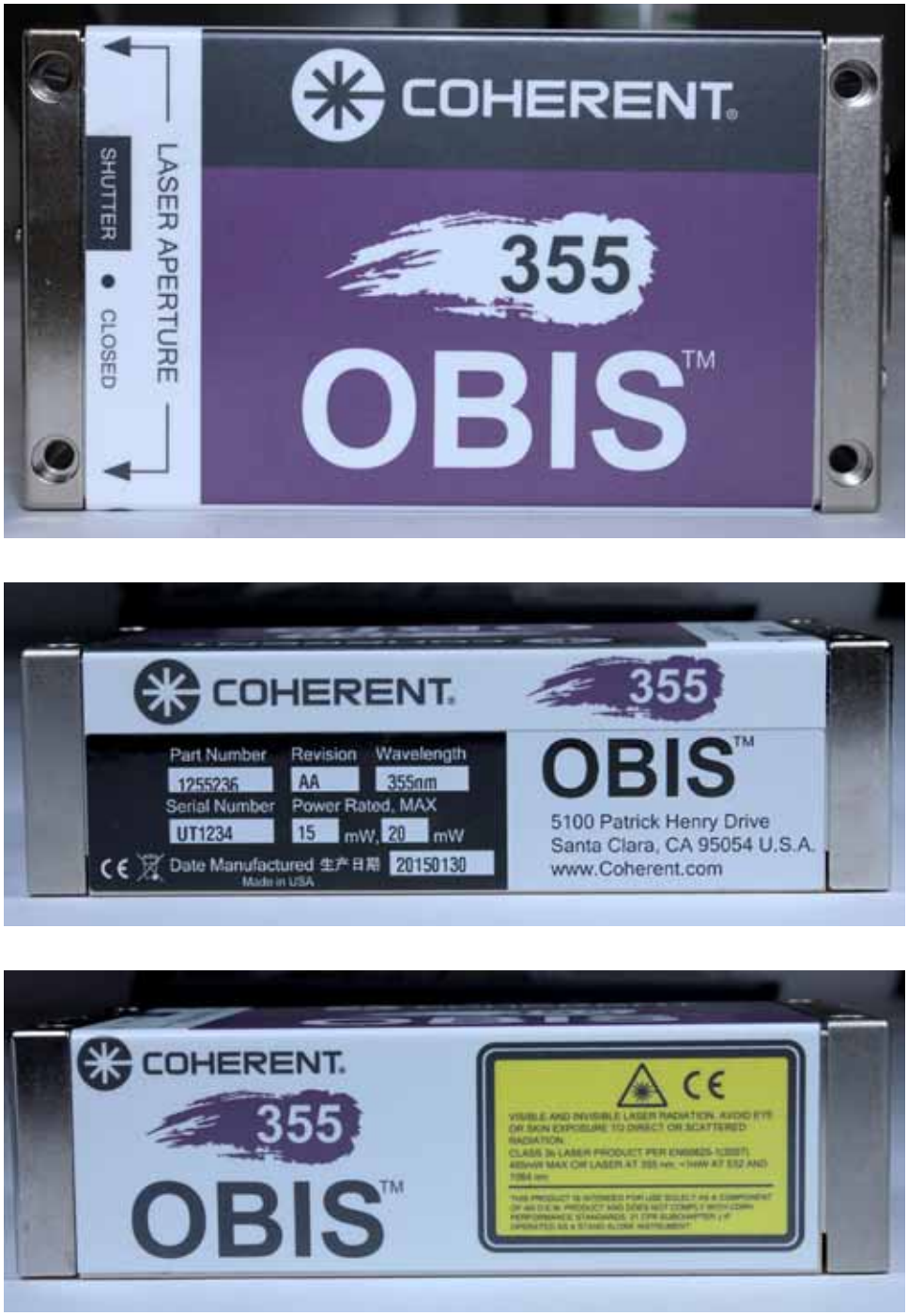


Figure 2-2. Laser Label Locations

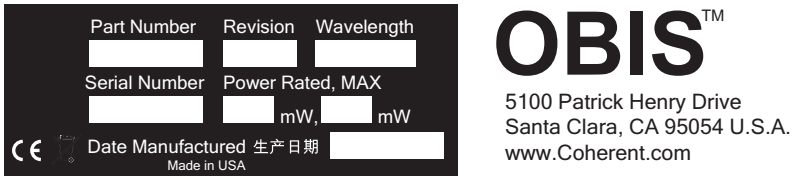
	Label	Description
1		Serial Number Identification
2		Radiation Warning (355nm)
		Radiation Warning (460nm)
		Radiation Warning (479nm)
		Radiation Warning (532nm)

Table 2-2. Label Description - Laser Head

	Radiation Warning (561nm)	
	Radiation Warning (590nm)	
3	RoHS 20 Year EFUP	

Table 2-2. Label Description - Laser Head (Continued)

2.8 Sources of Additional Information

The following are sources for additional information on laser safety standards and safety equipment and training.Figure 2-3

2.8.1 Laser Safety Standard

American National Standard for Safe Use of Lasers
ANSI Z136 Series
American National Standards Institute (ANSI)
www.ansi.org

Performance standards for light-emitting products
21 CFR Title 21 Chapter 1, Subchapter J, Part 1040
U.S. Food and Drug Administration
www.fda.gov

2.8.2 Publications and Guidelines

Safety of laser products - Part 1: Equipment classification and requirements
IEC 60825-1 / EN 60825-1

Safety of laser products - Part 14: A user's guide
IEC 60825-1 / EN 60825-1

Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use
IEC 61010-1 / EN 61010-1

International Electrotechnical Commission (IEC)
www.iec.ch

Safety of laser products - Part 1: Equipment classification and requirements
BS EN 60825-1
British Standard Institute
www.bsigroup.com

A Guide for Control of Laser Hazards
American Conference of Governmental
and Industrial Hygienists (ACGIH)
www.acgih.org

Laser Safety Guide
Laser Institute of America
www.lia.org

2.8.3 Equipment and Training

Laser Focus Buyer's Guide
Laser Focus World
www.laserfocusworld.com

Photonics Spectra Buyer's Guide
Photonics Spectra
www.photonics.com

3 Description

3.1 System Description

OBIS LG is a family of OEM lasers for scientific and bio-instrumentation applications based on Coherent's patented Optically Pumped Semiconductor Laser (OPSL) technology..

Figure 3-1. OBIS LG

3.1.1 Features:

- Laser head and control electronics contained in a single box
- Common package for all power levels and wavelengths
- Compact size
- Flexible mounting features
- Configurable startup behavior

- Industry standard connector
- USB and RS232 control interfaces

3.2 Theory of Operation

The gain medium is an optically pumped semiconductor, where the carrier electrons in the quantum wells are excited by an 808nm laser diode pump (See Figure 3-2). The emission wavelength is engineered by the composition and thickness of the gain medium.

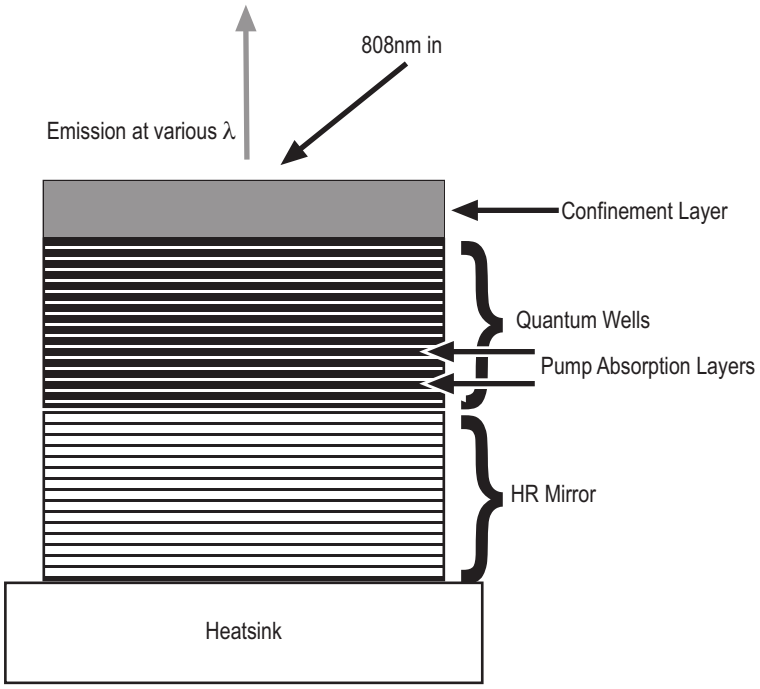


Figure 3-2. OPSL Diagram

The total height of the semiconductor quantum wells and the underlying dielectric layers that act as a rear surface total reflector is less than 10 microns. The bottom surface is bonded to an actively cooled heat sink, efficiently cooling the semiconductor structure. Although a radial thermal gradient still results from laser operation, the entire structure is so thin that thermal lensing is negligible.

The emitted radiation is then converted to visible and UV wavelengths by frequency conversion with non-linear crystals.

3.3 Specifications

For specifications, refer to the data sheet supplied with the system or the specification sheet on the Coherent Web site.

Table 3-1. Utility Requirements, Dimensions and Weights

PARAMETER	VALUES
Electrical	
Input Voltage (DC)	24 V ± 10%
Power Consumption	<150 W (Visible wavelengths) <125 W (UV wavelengths)
CE Mark	EN61010-1, EN60825-1, EN61326-1, EN55011, EN50581
Dimensions	
Laser Head with Integrated Controller (L x W x H)[a]	125.0 x 70.0 x 36.2 mm (4.9 x 2.76 x 1.43 in.)
Weights	
Laser Head with Integrated Controller	581 g (1.28 lbs)
Environmental Specifications	
Ambient Temperature: Operation Non-Operation	 10 - 40 °C (50-104°F) -10 - 60 °C (14 - 140 °F)
Warm-up Time	<5 minutes
Relative Humidity (non condensing)	5 - 95 %

a. Back connector not included in laser head length dimension.

3.4 Dimensions

The dimensions of the OBIS LG laser subsystem are shown in Figure 3-3.

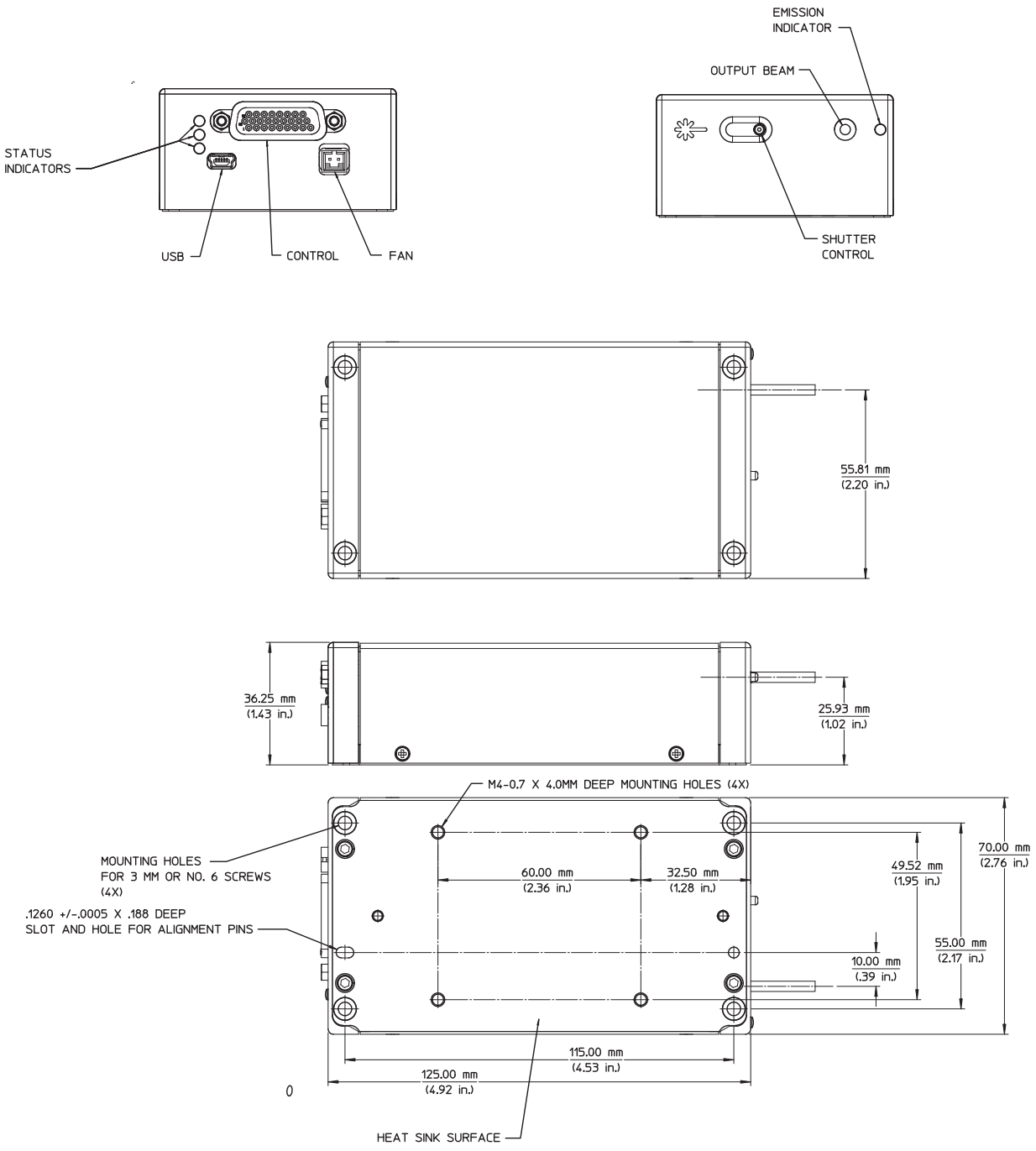


Figure 3-3. OBIS LG Dimensions

4 Installation and Integration

4.1 Receiving and Inspection

Inspect the shipping containers for indications of rough handling or damage. Indicate any signs on the bill of lading. Report any damage to the shipping carrier, and to Coherent Order Administration Department (800-367-7890, or 1-408-764-4557 outside the US) or to an authorized Coherent representative immediately.

NOTICE

Keep the shipping containers. The containers are required if the system is returned to the factory for service. The containers may also be needed to support a shipping damage claim.

1. Power Supply
2. Laser Head
3. Cable Assembly, Obis Power to Laser, HD 26 Pin
4. Power Supply Cables
5. USB Cable

Figure 4-1. OBIS LG in Shipping Box[a]

a.Check the contents against the packing list. Contents are different for different configurations.

In order to use the OBIS LG laser system as part of an instrument several aspects need to be considered and provided for.

4.1.1 Mechanical / Thermal Interface

The laser head must be secured to the instrument by means of M3 or #6 screws through the mounting holes located on the corners of the laser head. The same mounting holes can be used to mount the laser in either orientation, from the top or upside-down. The laser can be attached either from the top, using the pattern of through holes (M3 or #6 screws) on the laser head (Figure 4-2), or the threaded holes (M4-0.7) in its base (Figure 4-3). Refer to Figure 4-5 for dimensions of the mounting pattern.

Note that the excess heat produced by the laser during operation must be extracted by a heatsink attached to the laser baseplate. A standard heatsink can be supplied by Coherent (shown pictured in Figure 4-2 below) or can be designed by the user (requirements shown in Figure 4-5 on page 4-28).

All screws used to secure the laser and heatsink must be torqued to 10.5 in-lbs or 1.2 N-m in an iterative star pattern, successively tightening each screw until the final torque is reached.

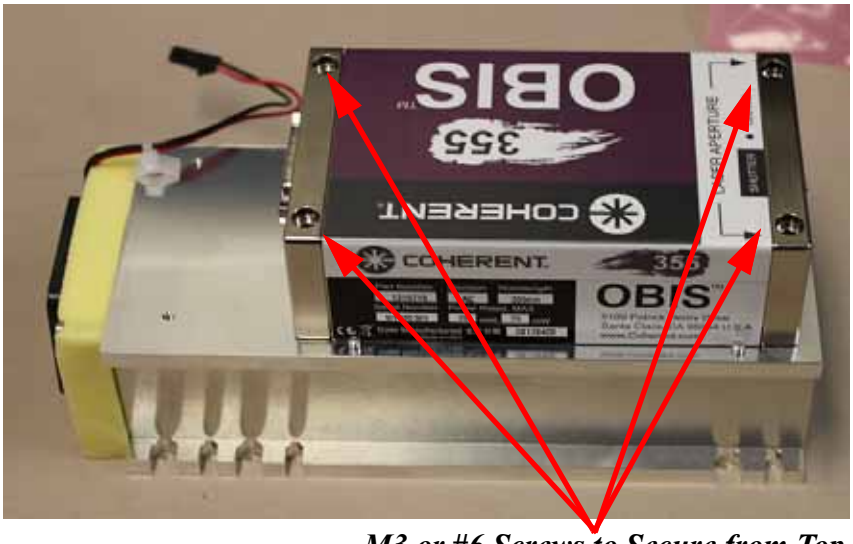


Figure 4-2. Laser with Heatsink

Refer to Figure 4-4 and Figure 4-5 for the laser connections and the required dimensions of the thermal interface.

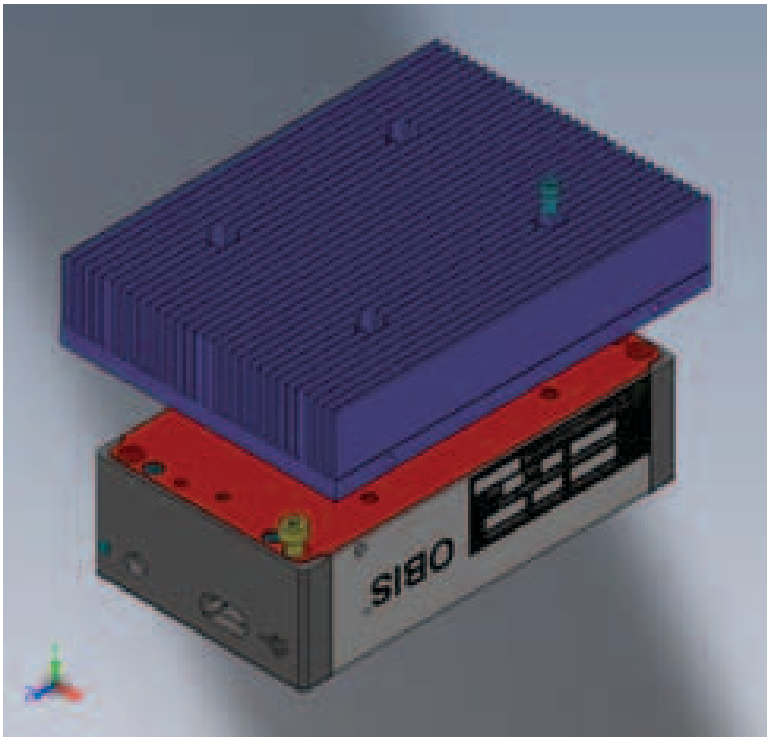


Figure 4-3. Laser Secured Upside Down

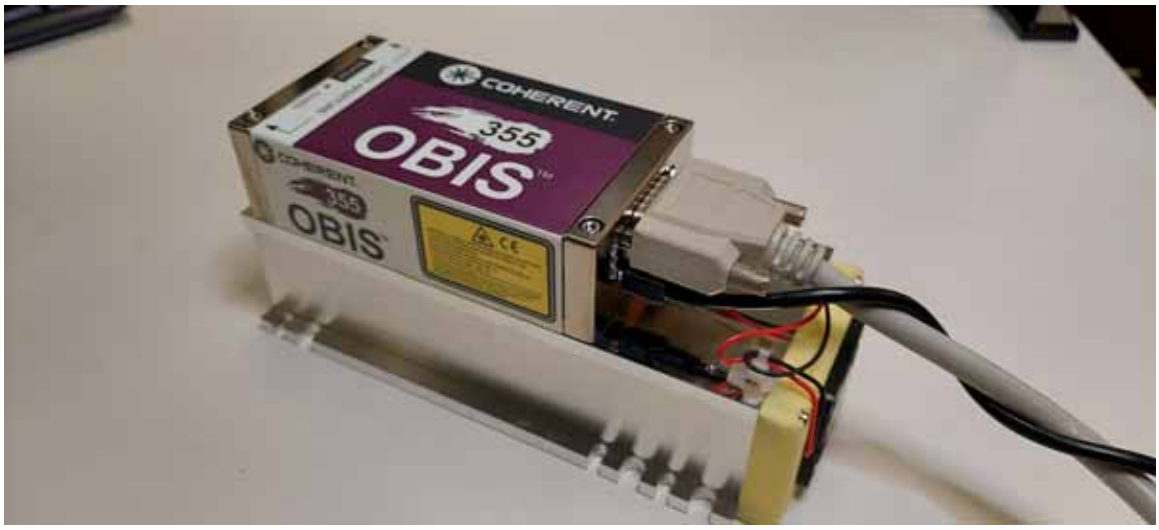


Figure 4-4. OBIS LG Connectors

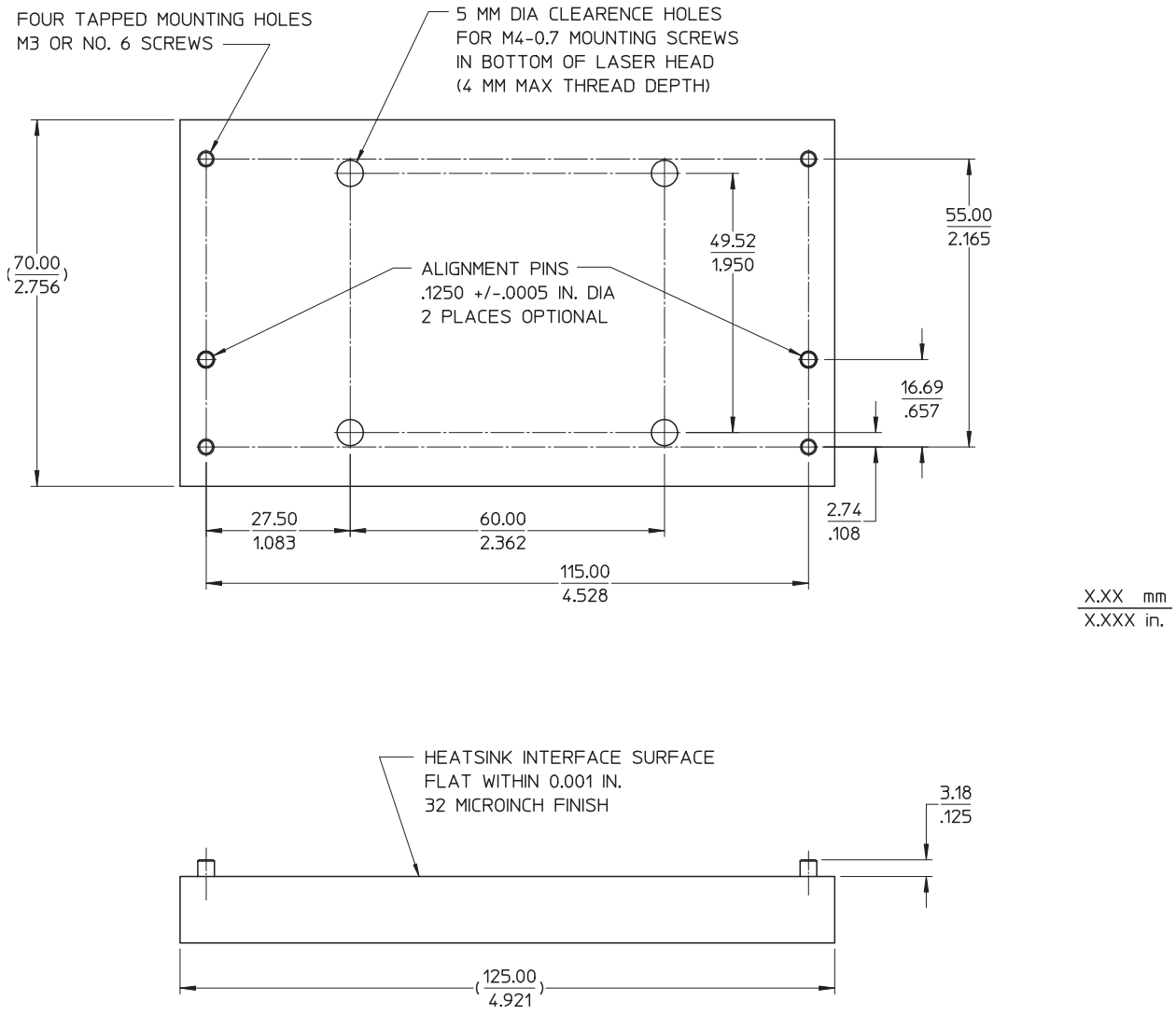


Figure 4-5. Thermal Interface Requirements

4.1.2 Heatsink Design Guidelines (For Use with Non-Coherent Heatsink)

The OBIS LG laser system is available in UV and visible outputs. The heatsink requirements are different for the two different lasers.

For this discussion, the heatsink will be characterized by its thermal impedance[1].

Maximum ambient operating temperature is determined by the heatsink properties and the output power of the laser. See Figure 4-6 to find the correct the heatsink requirements. Figure 4-6 gives the maximum operating temperature as a function of the heatsink thermal impedance for the OBIS LG.

NOTICE

The heatsink temperature must be maintained at less than 60 º C. At 60 º C, the laser will shut down.

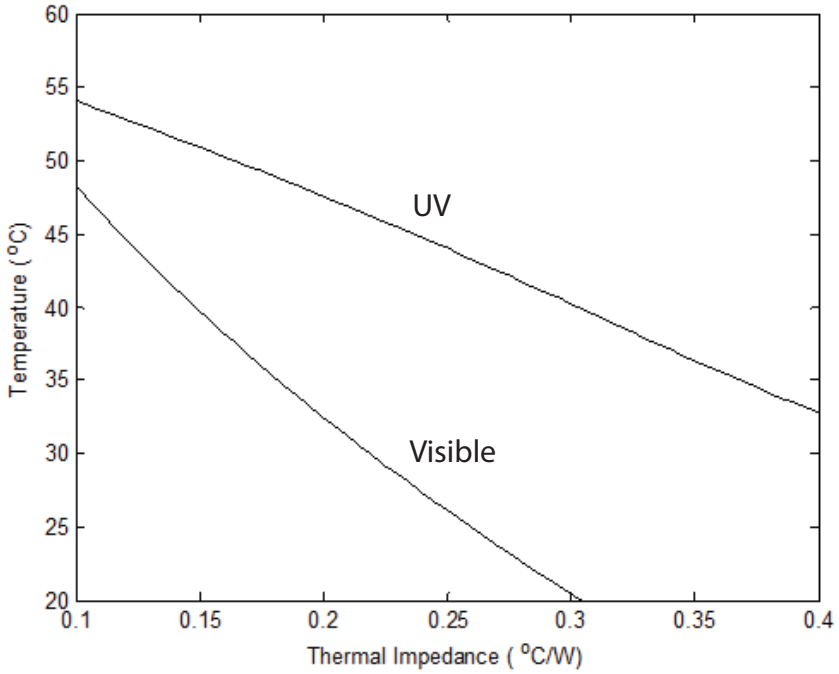


Figure 4-6. Heatsink Requirements

1. Difference in temperature between the hot surface and the environment for each Watt of dissipated power

Another important parameter to note is the amount of heat that the heatsink will deposit in the environment. Most of the excess heat comes from the internal TECs that keep the laser-critical components at safe operating temperatures. The excess heat for normal operating conditions (within the limits of Figure 4-6) are shown in Figure 4-7. Figure 4-7 shows the maximum amount of heat deposited on the heatsink when the laser is operated at the maximum temperature from Figure 4-6. The shape of the curve for the UV laser is caused by different limiting mechanisms: Thermal runaway for high thermal impedance heatsinks and baseplate temperature safety interlock limitation for low impedance.

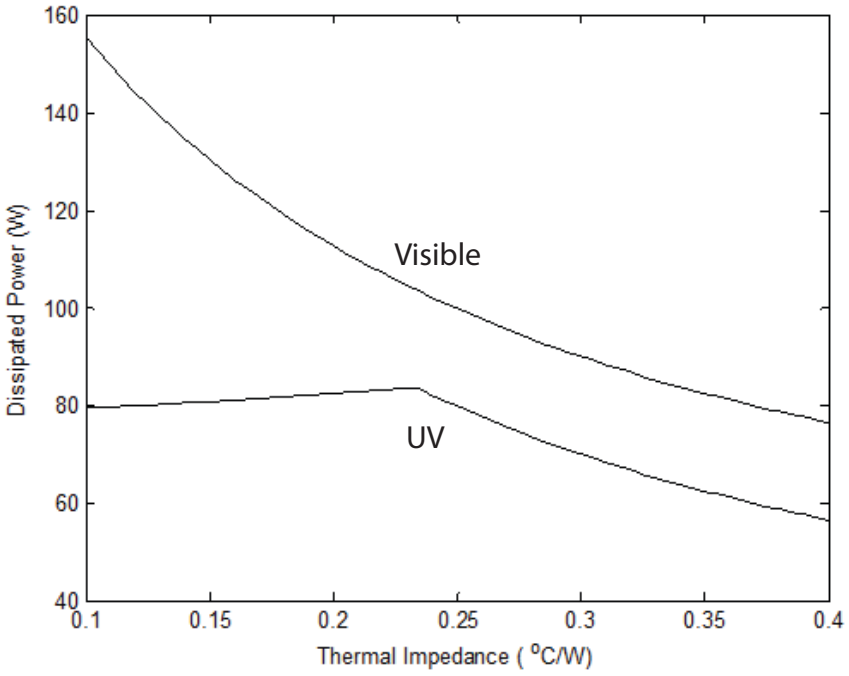


Figure 4-7. Power Dissipated in the Heatsink

4.1.3 Power and Control

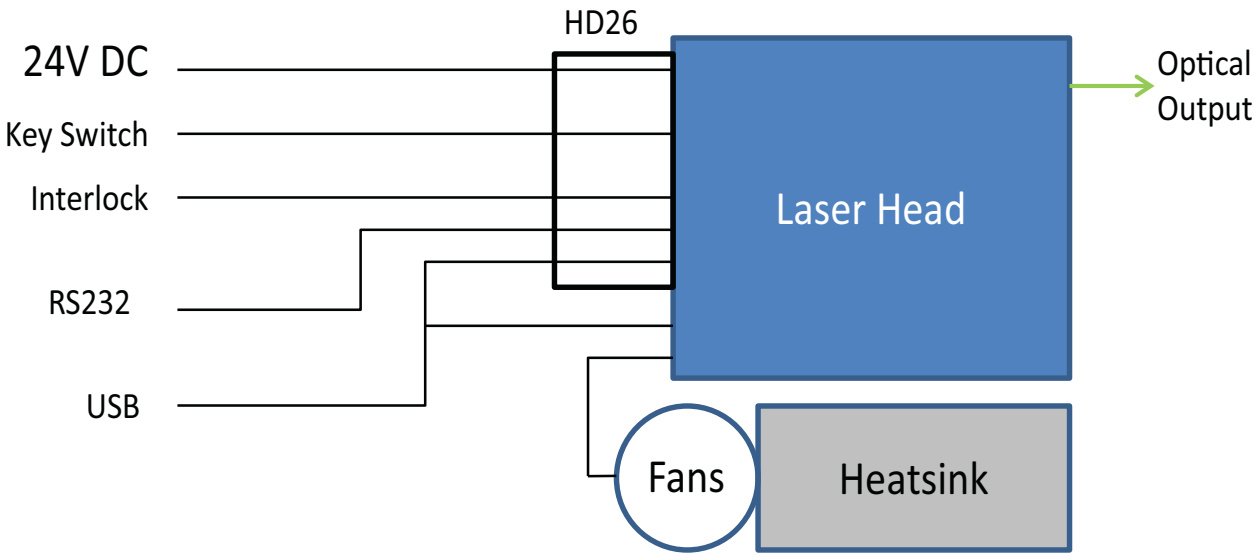


Figure 4-8. Connection Block Diagram

The laser can be configured to only require a source of 24V DC to emit a beam at the necessary optical output power.

NOTICE

Do not change or connect the 26-pin cable to the laser head while the laser or power cable is active.

Integrate the laser in CDRH compliant tools with the external interlock and remote keyswitch connection points.

The OBIS LG has both USB and RS232 connections. The HD26 connection of the OBIS LG includes pins for the USB and RS-232. The laser head also includes a separate mini-USB connection on the back of the unit. Both the USB and RS-232 connections are available for initial configuration and for the continuous computer monitor function.

4.1.4 Head Control Connector

Access connections for 24VDC, keyswitch, interlock, RS232 and USB are through the HD26 connector in the back of the unit. The pin assignments are shown in Table 4-1 .

Pins 7,8,9,17,18,25 and 26 on the connector are used only for the 24V power source for correct distribution of the current load. Use cable with AWG 26 conductors for correct current carrying capability.

Two pins each are dedicated to the interlock and enable (remote key switch) loops. Both circuits must be closed for laser to start. Any external interlock or keyswitch circuit must be equivalent to a mechanical closure of the circuit. When the interlock is opened, the unit will terminate laser emission. An optically isolated transistor (for example the MOC213) or a dry contact relay is recommended. The external circuits must be able to handle 12.5 mA of current and withstand as much as 24V when open. When the circuit is closed, the voltage drop must be less than 1 V.

Pins 1 and 2 provide the interlock function – interlock latches off. Pins 3 and 4 provide the enable function– enable does not latch and gives 5 second on delay. Note that the "+" and "-" terminals indicate the current flowing from the "+" terminal to the "-" terminal, so an LED can be inserted into the circuit if desired for an INTERLOCK OK and/or LASER ON indicator.

For applications that require monitoring the laser status continuously, the HD26 connector has pins for USB and RS232 control. For other applications that may require computer control for initial configuration only, disable signals to pins 10 and 11 and use the Mini B5-USB connector at the back of the unit. Only one USB connection can be used at a time.

Table 4-1. Pin Assignments HD 26 Connector

Signal	Pins
+24V	7,8,9,17,18,25,26
PGND	5,6,14,15,16,23,24
INTLK+	1
INTLK-	2
Enable+	3
Enable-	4
USB+	10
USB-	11
USB VCC	22

Table 4-1. Pin Assignments HD 26 Connector

GND	21[a]
RS-232 RX	19
RS-232 TX	20

a.This GND is used only for RS-232 and USB. Do not substitute with PGND.

4.1.5 Startup Configuration

Depending on the application and the design of the instrument, different behavior from the laser may be desired when power is applied. Several options are available and can be selected by means of configuration commands issued through the computer interface. After this initial configuration the laser will behave as desired when power is applied, regardless if a computer is connected to the laser. This feature is useful in particular for instruments without continuous computer control where operation at a set power is desired.

When power is first applied to the laser it goes to the “warm up” state, during which internal components are taken to operational temperature and enough time is allowed for them to stabilize. Laser emission is not possible during warm up. After warm up is complete the laser will take one of three possible actions depending on the chosen configuration:

- **CDRH compliant with remote key**: The laser expects a remote key switch (to be provided by the user) to be connected. If the key switch is open the laser enters standby state until the key switch is closed (user action). If the key switch is already closed when the laser attempts to enter standby, the laser goes into the fault state (laser does not turn on without user action).

- **CDRH compliant with virtual key (default configuration)**: The laser expects the enable line to be shorted, or if a remote key switch is used it expects the key switch to be closed at power up. The laser enters standby state after warm up. Laser action only occurs after a command is received through the computer interface (user action). Please note that if a remote key switch is used, laser light is only emitted when both the remote and the virtual key switches are closed.

- **Auto ON:** This mode should only be employed if the laser radiation is contained within the instrument and the interlock is connected to switches at any openings allowing exposure. After warm up the laser will turn on at a preprogrammed power level without any user intervention.

4.1.6 USB Driver Installation

The OBIS LG USB driver is a Windows communications device class driver. The driver operates like a standard serial port. After the driver is installed, the OBIS LG appears in the list of ports in the Device Manager.

1. Download the **CohrHOPS.inf** file from the www.coherent.com web site. This file will be needed in Step 6.
2. Connect the USB cable between the OBIS LG and the computer. Apply power to the OBIS LG.
3. If **CohrHOPS.inf** has already been installed, Windows reports that device is **Ready to use**. Installation is complete.
   If **CohrHOPS.inf** has not been installed previously, Windows reports **No driver found.**

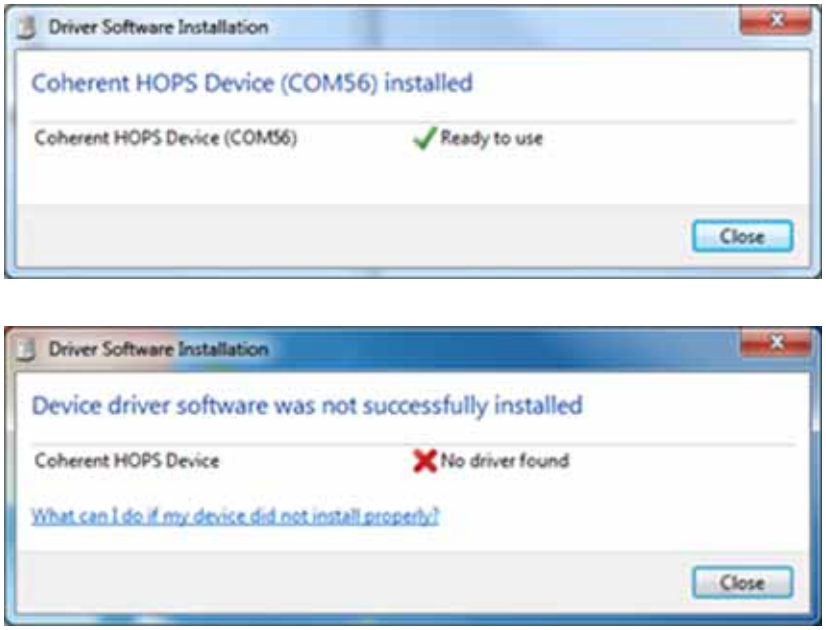


Figure 4-9. Ready to use/No driver found

4. Find the **Coherent HOPS Device** in the **Device Manager**. It will show an exclamation mark. Right click on **Coherent HOPS Device** and select **Update Driver Software** (see Figure 4-10).
5. Select **Browse my computer for driver software** (see Figure 4-11).
6. Find the folder that has **CohrHOPS.inf**. Click **Next**.
7. Windows will report successful driver installation.

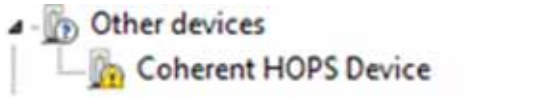


Figure 4-10. Update Driver Software

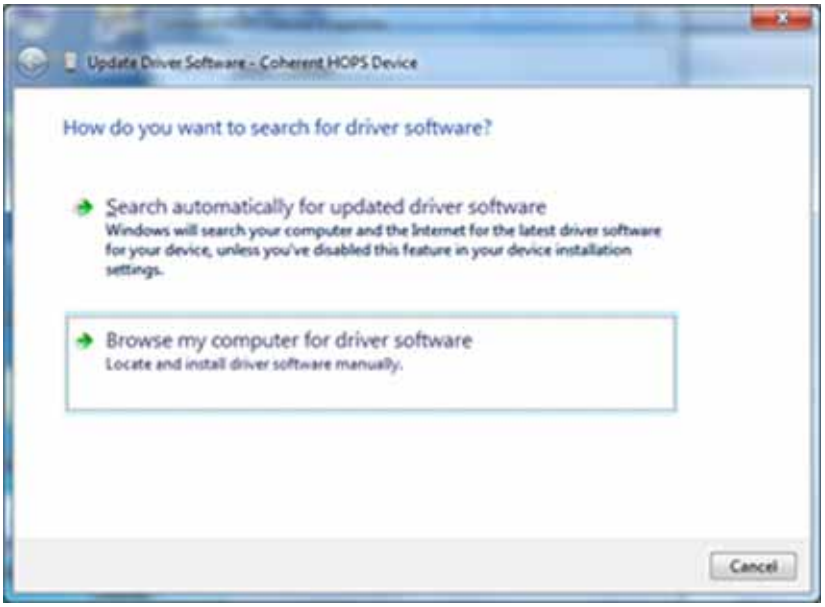


Figure 4-11. Browse My Computer

8. Confirm that the OBIS LG appears as **Coherent HOPS Device** in the **Device Manager**.

4.1.7 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 download the Coherent Connection software, go to:
www.coherent.com/resources

To find and install the Coherent Connection software and related drivers:

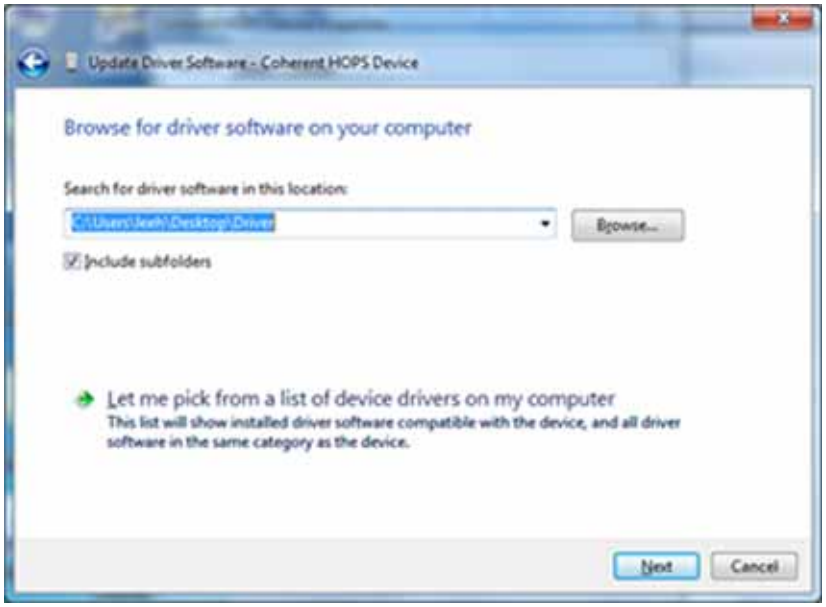


Figure 4-12. CohrHOPS.inf

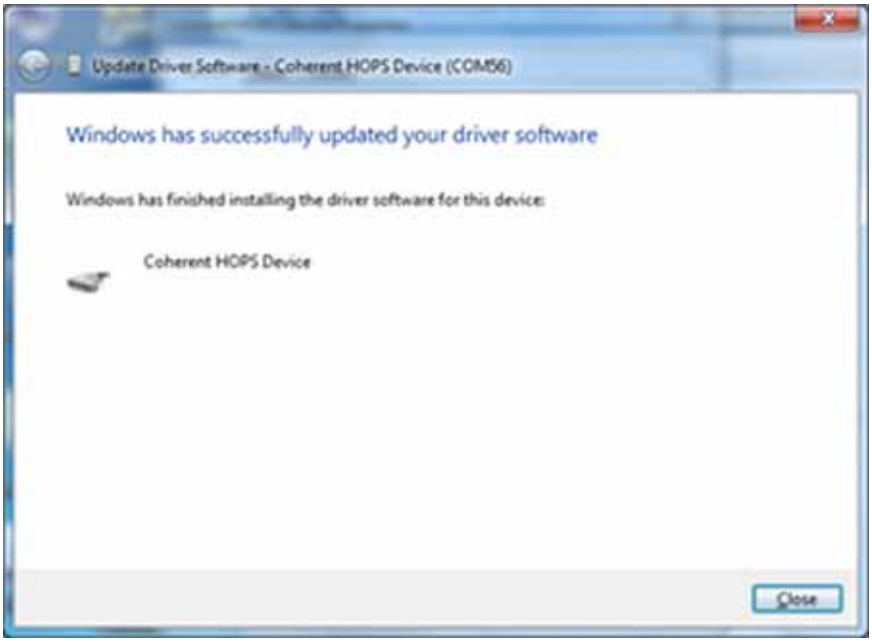


Figure 4-13. Successful Installation

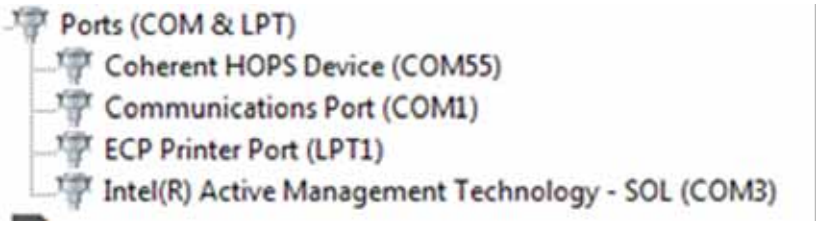


Figure 4-14. Device Manager

1. Close all programs.
2. To install Coherent Connection software, you must first connect the OBIS laser system to a workstation (personal computer or laptop) using a USB or RS-232 connection (Figure 4-15). Connect the OBIS LG laser from the back panel of the laser to a USB port on the host computer. Note that the RS-232 interface can only be accessed through the 26-pin interface. There is no separate connector for RS-232. For information about RS-232 pin-outs, see Table 4-1 (p. 32).

Figure 4-15. Connectors for a USB or RS-232 Connection

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 4-16, select the language in which to display the software and click OK.
5. If you had previously installed the Coherent Connection software, the message shown in Figure 4-17 is displayed. Click Yes to proceed.

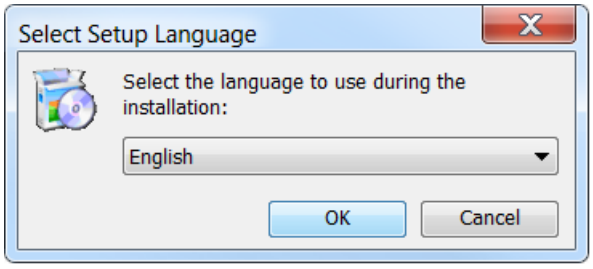


Figure 4-16. Select Language for Software

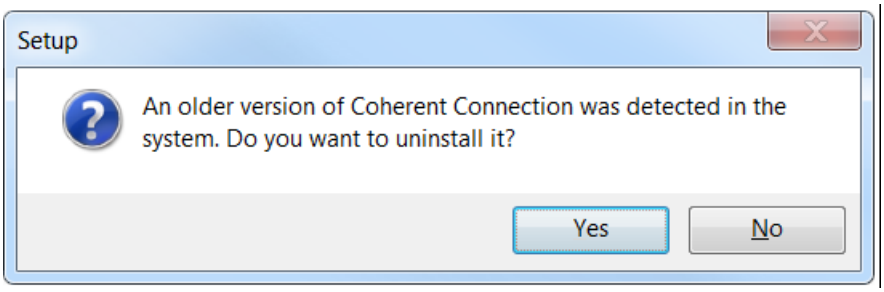


Figure 4-17. Uninstall Old Version of Software

6. The Welcome screen shown in Figure 4-18 is displayed.

Figure 4-18. Welcome Screen for Installation

7. Read the instructions, then click Next. The License Agreement shown in Figure 4-19 is displayed.

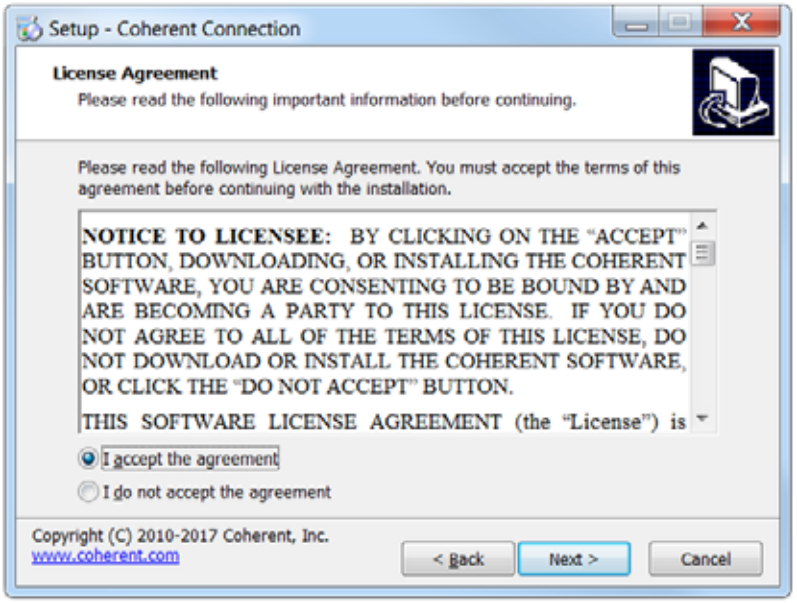


Figure 4-19. Coherent Connection 4 License Agreement

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.

9. The window shown in Figure 4-20 is displayed. Accept the selection, or browse to select the directory on the workstation where you want to install the software, and click Next.

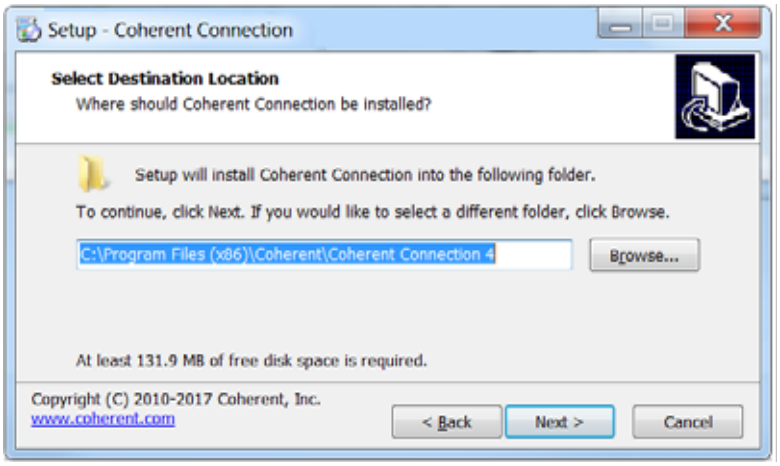


Figure 4-20. Select Directory to Install Software

10. You can create an icon for the software either on your desktop or for a Quick Launch (or both). As shown in Figure 4-21, click the appropriate check box, and then click Next.

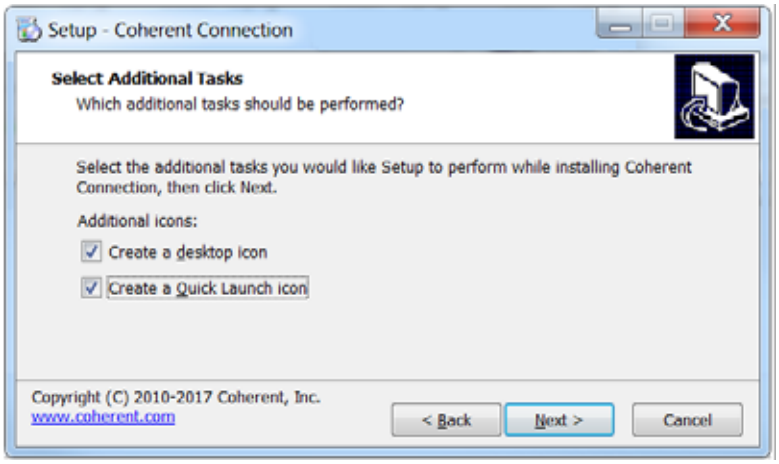


Figure 4-21. Set Desktop or Quick Launch Icon

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 4-22, and then click Next.

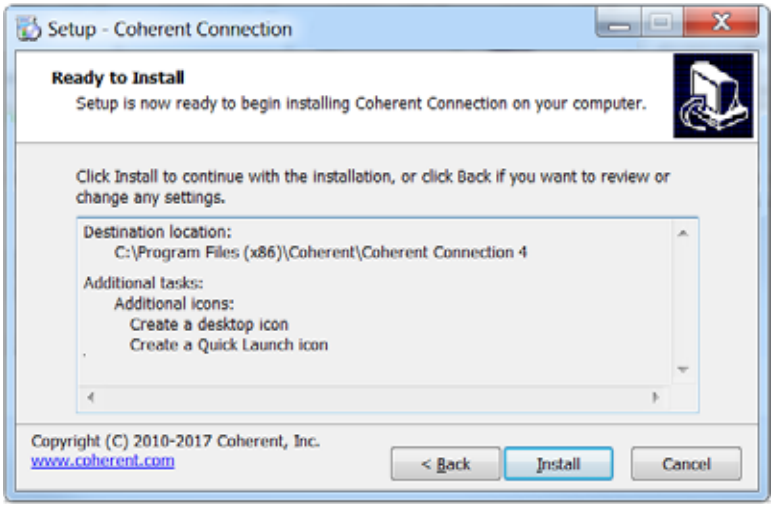


Figure 4-22. Review Set-Up before Installation Begins

A progress bar is displayed, as shown in Figure 4-23.

12. During the installation process, some files are extracted, as shown in the example in Figure 4-24.

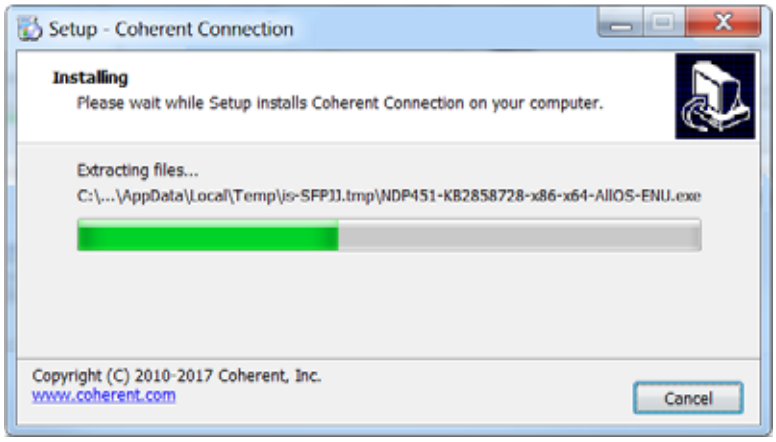


Figure 4-23. Progress of Installation

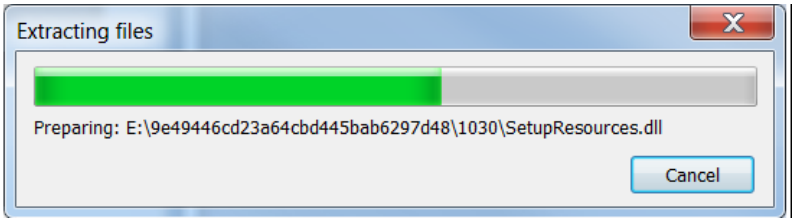


Figure 4-24. Extracting Files

13. After all files are extracted, click Finish. The screen shown in Figure 4-25 closes and the software is ready to be launched.

Figure 4-25. 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 4-26:

Figure 4-26. 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 4-27.

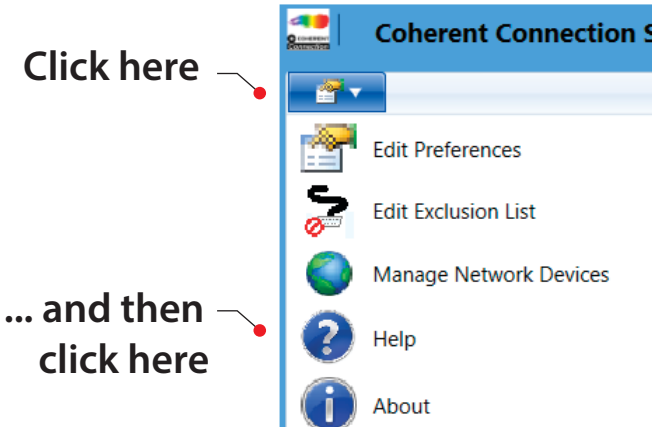


Figure 4-27. Coherent Connection HELP Menu Option

For additional information, go to the Coherent website

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

View product information and related materials, including Software files, as shown in the example web page in Figure 4-28:

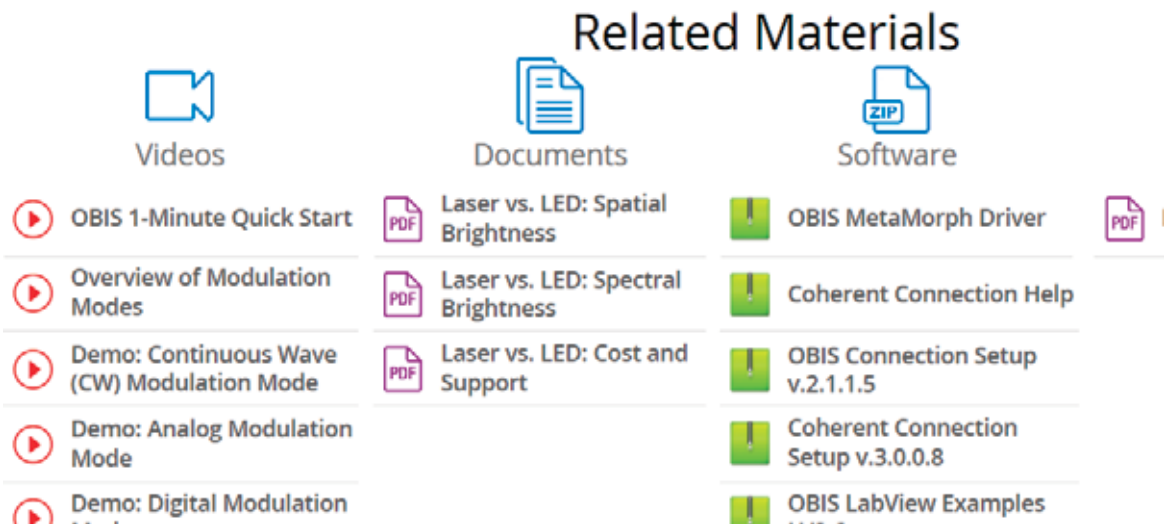
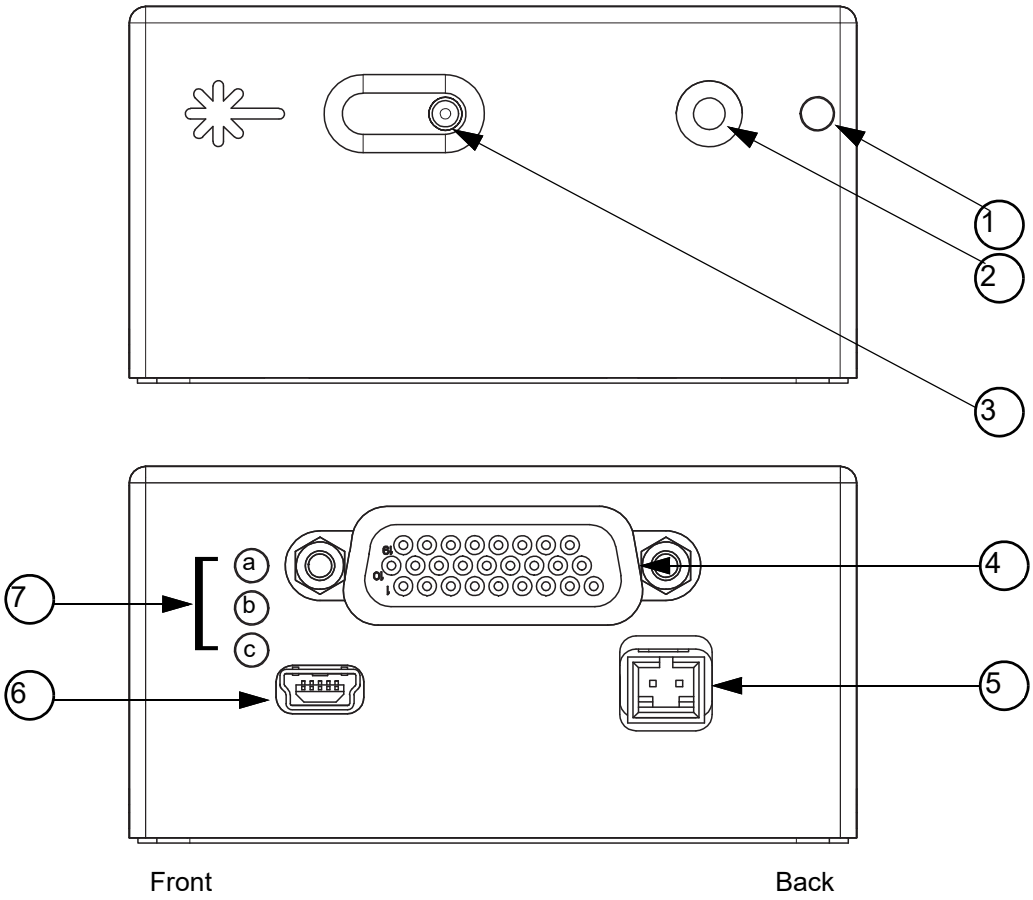


Figure 4-28. Related Product Materials on Coherent Website

5 Controls, Indicators and Features

5.1 Laser Head



1. Emission Indicator (yellow when ready for emission)
2. Output Beam
3. Shutter Control (shown closed)
4. Head Control Connector
5. Fan (<1 A @ 24 V)
6. Mini-B5 USB
7. Status Indicators
   a. Interlock OK (yellow)
   b. Laser On (green)
   c. System Fault (red)

Figure 5-1. OBIS LG Indicators and Connections

6 Operation

6.1 Operation

Once installation is complete, the laser is ready for operation. The laser does not include any manual control (other than the safety shutter). All commands are given through the computer interface.

The Coherent GUI provides advanced troubleshooting in addition to control of laser parameters and providing status updates. It is recommended when operating a single laser.

Coherent Connection provides another easy-to-use interface between a Coherent OBIS Laser 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 Coherent Connection software is recommended when operating multiple lasers.

Refer to “Host Interface” for a full description of the computer interface using a terminal program or a custom-developed program.

NOTICE

Do not change or connect cables to the laser head while the laser or power cable is active.

6.2 USB and RS-232 Remote Monitor

The communication protocol is the same for the USB and RS-232 connection. See Table 6-1 and Table 6-2 below for the RS-232 communication settings and factory default settings. The RS-232 and USB connections in the HD26 connector can be used simultaneously, but the two USB connectors (mini-B and the pins in the HD 26 connector) cannot be used simultaneously. Commands are executed in the order they are received, with no priority given for any connection. In addition to the OBIS command set, the OBIS LG is backwards-compatible with the HOPS command set (as listed in Table 7-3 (p. 68)).

Table 6-1. RS-232 Communication Settings

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

Table 6-2. Factory Default Settings

Description	Setting
Command prompt	OFF
Command handshake	ON
Laser emission auto start	OFF
CDRH delay	ON
Output power level	Nominal power
Minimum power output limit	0 watts
Virtual keyswitch start-up state	OFF
Maximum power output limit	110% nominal power
Operating mode	CW constant power (CWP)

6.3 Coherent/OBIS GUI Overview

One option for an interface between a Coherent OBIS Laser and a PC is the advanced Coherent GUI.

The Coherent GUI provides advanced troubleshooting in addition to control of laser parameters and providing status updates. It is recommended when operating a single laser.

The Coherent GUI for the OBIS LG laser has five menu tabs. Refer to Figure 6-1 for descriptions of the various tabs.

1. Main Tab - Contains the command panels for primary operation of the laser system.
2. Servos Tab - Information about the temperature servos baseplate temperatures.
3. Prompt Tab - A COMMAND Prompt window that enables the user to query and send commands.
4. Tools Tab - Provides various tools for managing laser firmware and selecting time zone..
5. About Tab - Provides Coherent GUI information, access to the Coherent web page, and other features

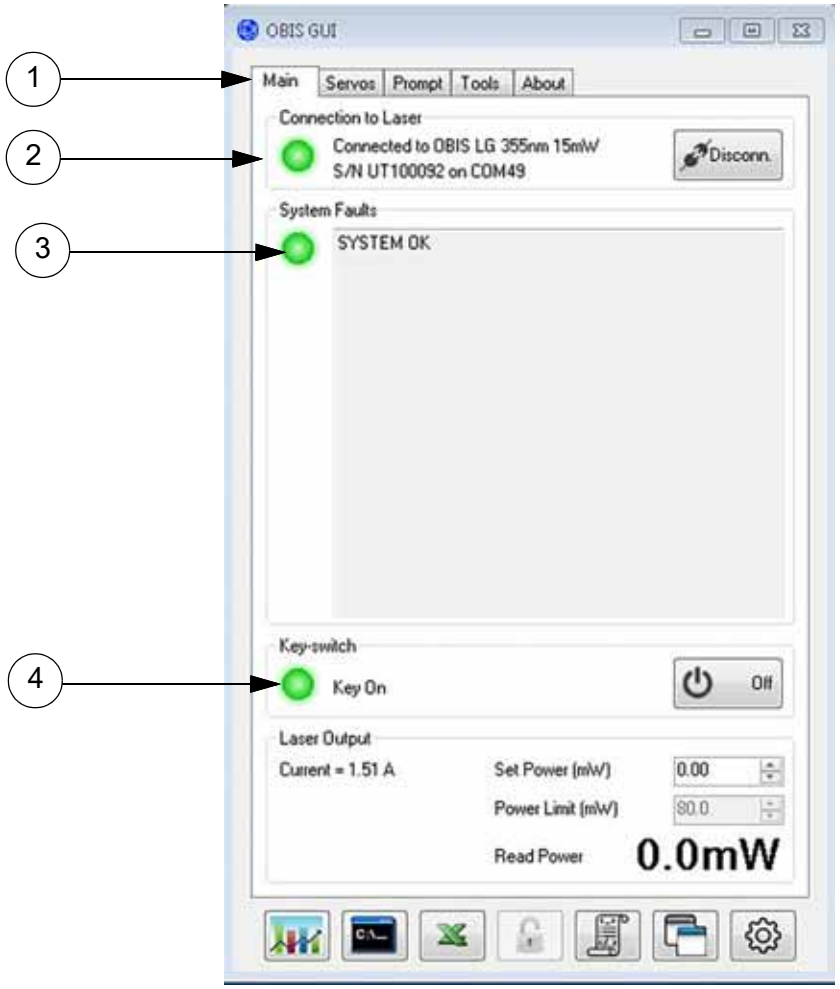
Figure 6-1. GUI Menu Tabs

6.4 Individual Menu Tabs Explained

The following subsections contain descriptions of each menu tab in the Coherent GUI.

6.4.1 Main Menu Tab

The Coherent GUI Main menu tab provides an overview of laser status and includes panels for primary operation of the laser system. For details, see Figure 6-2, below.



1. Main - Name of tab under discussion.
2. Connection to Laser Panel - Displays the communication status between control computer and laser, the active communication port, and setting options through the CONNECTION button.
3. System Faults Panel - Lists any active faults or warnings and provides the option to clear faults that have been addressed.
4. Keyswitch Panel - Displays the keyswitch status.

Figure 6-2. Main Menu Tab

6.4.2 GUI Connection Panel

The Connection to Laser panel on the Main tab allows the user to select a connection method between the laser and the control PC. By clicking the CONNECTION button in the panel, a Connection Options screen pops up as shown in Figure 6-3, below.

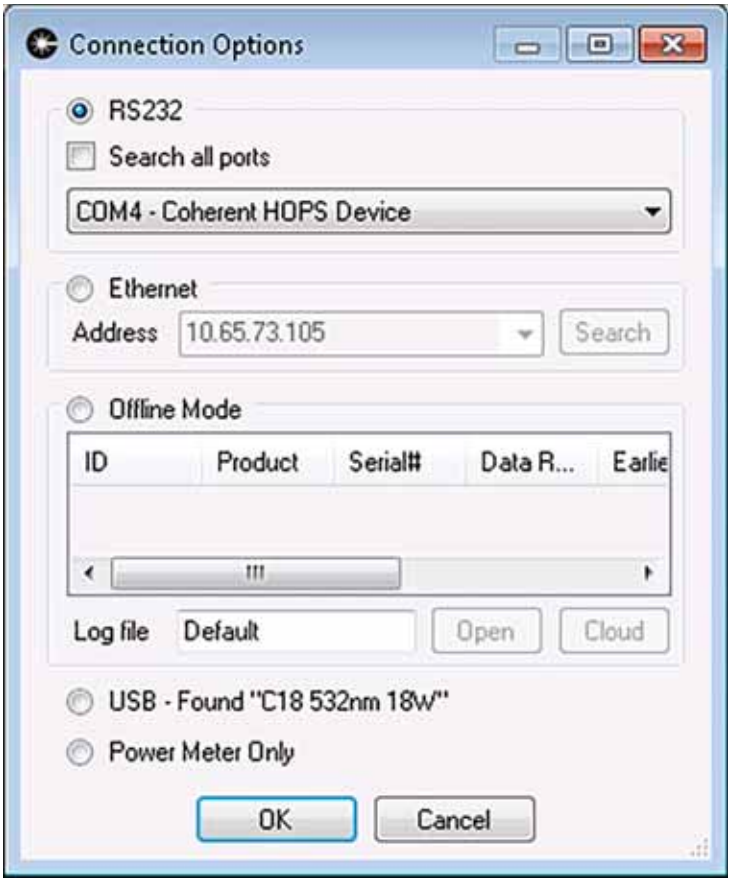


Figure 6-3. Connection Options Screen

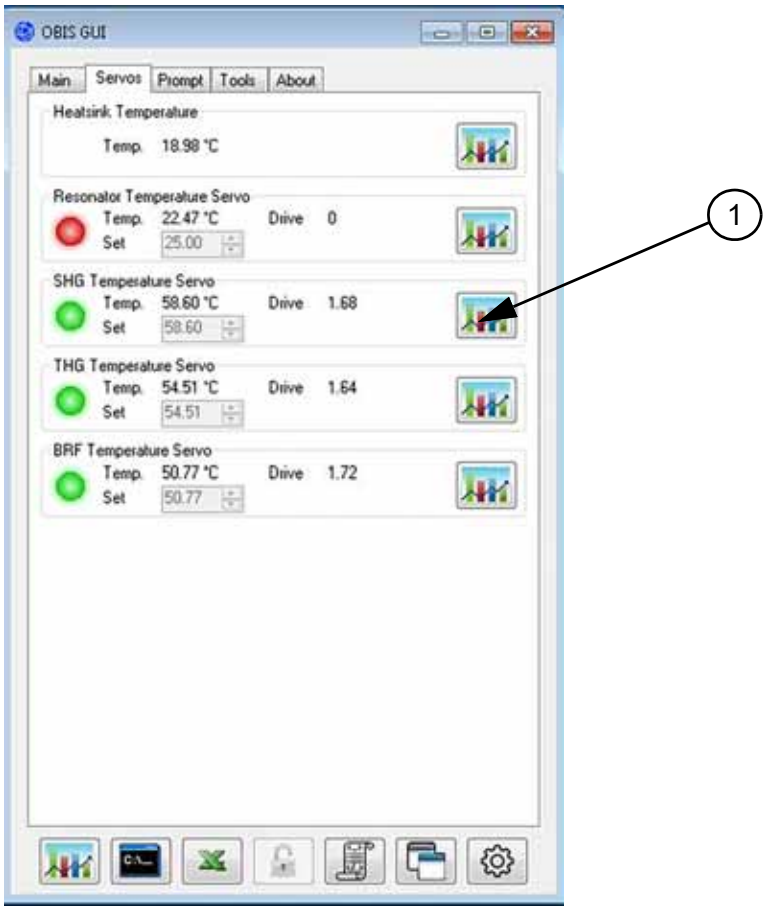
There are three available connection options that can be set up from the Connection Options screen: RS-232, Ethernet, and USB. Make sure proper cable connection is established before making selection in the Connection Options screen and clicking the OK button. The connection process may take a few minutes.

This panel also provides options to connect the GUI to a simulator or to Offline mode, in which no connection to a real laser is required. The GUI can also be connected to a power meter only.

6.4.3 Servos Menu Tab

The Servos menu tab displays temperatures inside the laser head (shown in Figure 6-4 foreground, below). The set temperature for the Baseplate and SHG can be adjusted.

The chart buttons open new windows to display system parameters in real time. These screens are highly configurable using the buttons on the screens. Configurable features include the graph scale; hiding old data; exporting the graph; showing or hiding the statistics panel; showing older data, more recent data, or the latest data; and zoom out. Using the drop-down menu, the chart can be set to examine a myriad of data captured by the data logger. See Figure 6-4, below.



1. Configurable Temperature Servo Data Chart (launched from Graph icon)

Figure 6-4. Servos Menu Tab

6.4.4 Prompt Menu Tab

The Prompt menu tab provides a command line for entering commands into the system. See Figure 6-5, below.

Figure 6-5. Prompt Menu Tab

6.4.5 Tools Menu Tab

The Tools menu tab provides access to a variety of tools to maintain and manage the OBIS LG laser system. Note that some buttons may require a higher access level, and are grayed out if that access is not allowed. See Figure 6-6, below.

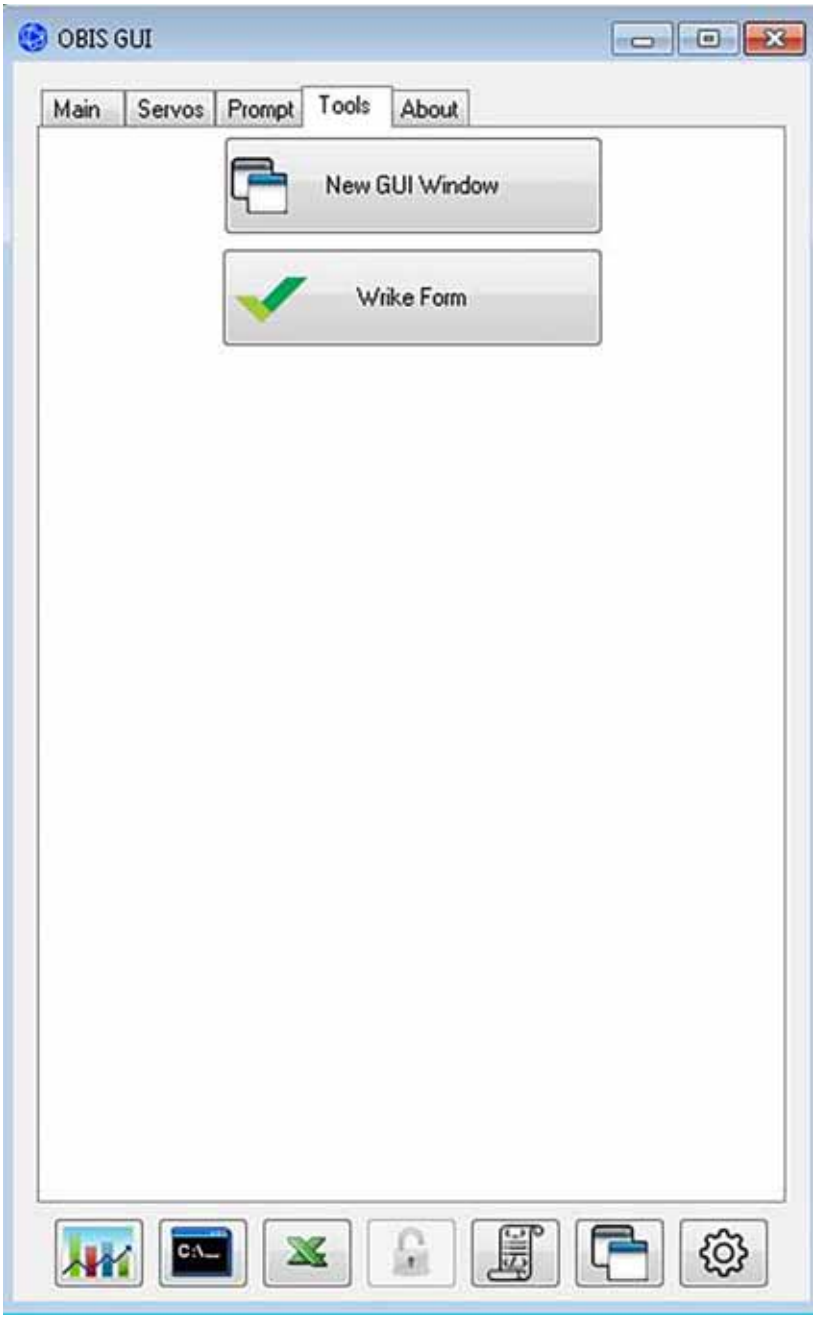


Figure 6-6. Tools Menu Tab

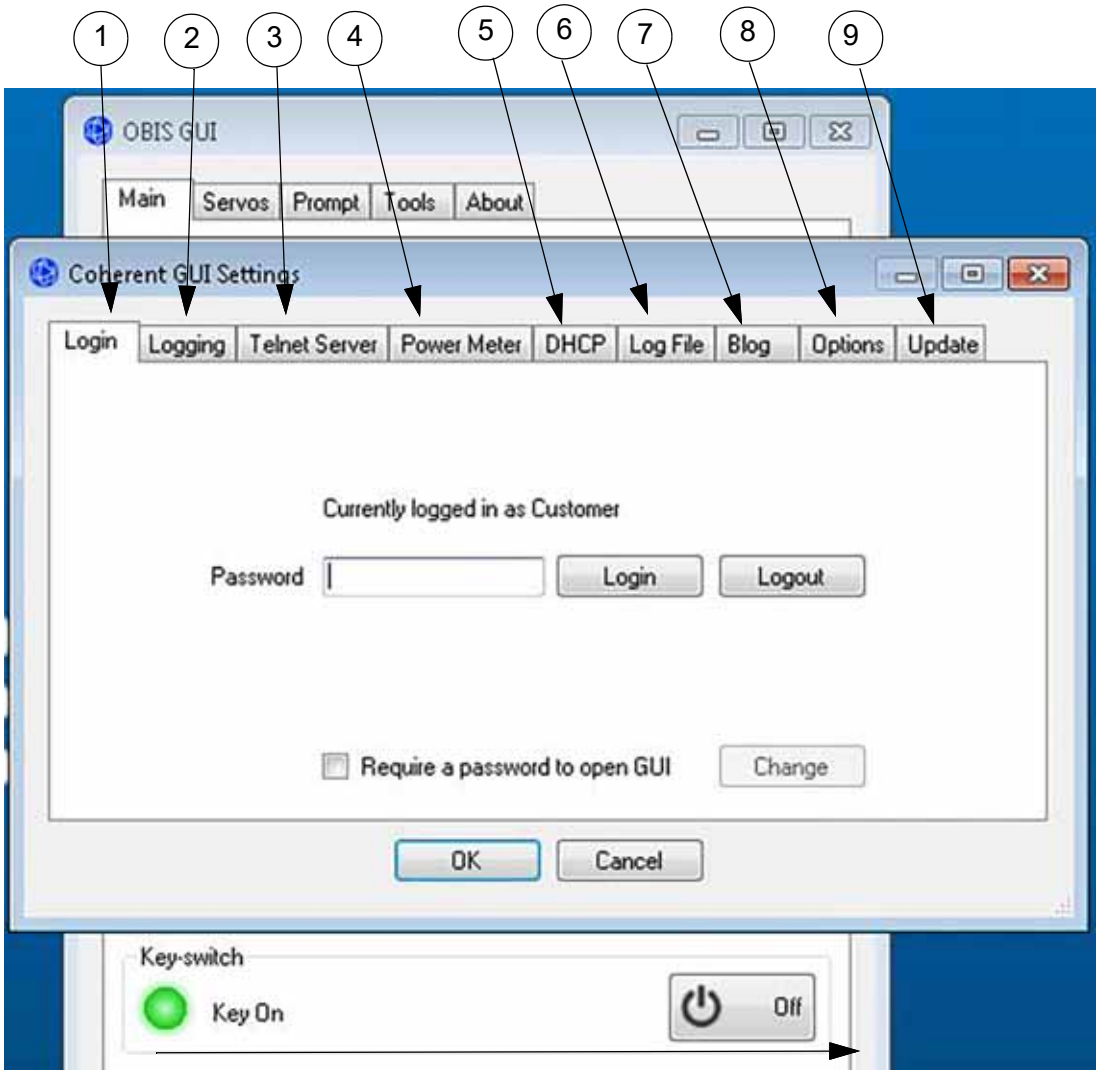
6.4.6 About Menu Tab

The About menu tab shows the version and build date of the Coherent GUI. It also provides links to OBIS LG and Laser web pages, the GUI and Laser Operator's manuals, and direct email access to the GUI developer. See Figure 6-7, below.

Figure 6-7. About Menu Tab

6.5 GUI Configuration

To change general settings of the Coherent GUI, click on the Adjust Settings icon at the bottom of the Main menu tab. See Figure 6-8, below.



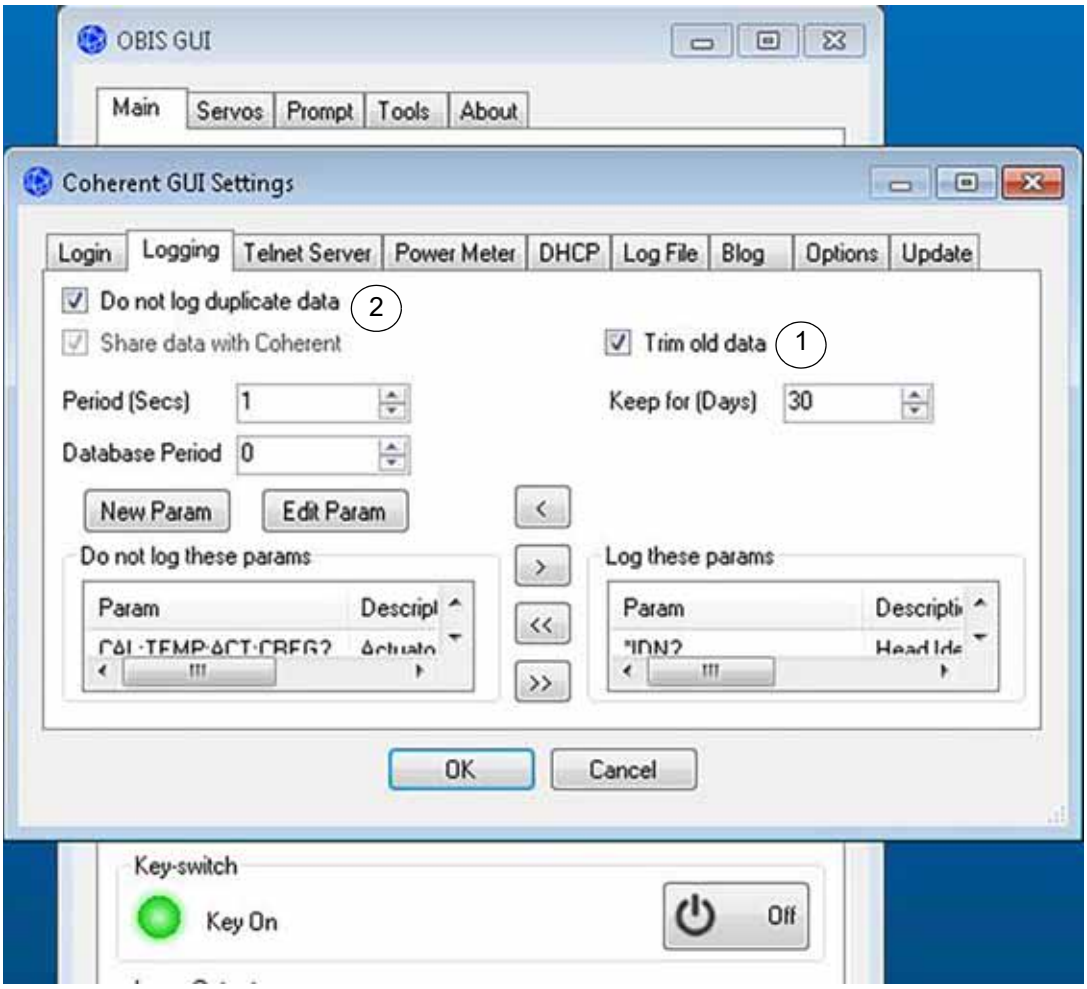
1. Login Tab (shown above)
2. Logging Tab
3. Telnet Server Tab
4. Power Meter Tab
5. DHCP Tab
6. Log File Tab
7. Blog Tab
8. Options Tab
9. Update Tab

Figure 6-8. GUI Settings

6.5.1 Logging

The Logging menu tab allows you to set the data polling frequency period and the Database period as well as select which data parameters to log.

1. Select the Adjust Settings icon at the bottom of the GUI screen.
2. Select the Logging menu tab on the Coherent GUI Settings screen.
3. To limit the amount of data stored in the data logger, check the “Trim old data” check box and set the time duration limits accordingly.
4. To save datalogger storage space, check the “Do not log duplicate data” check box as shown in Figure 6-9.



1. Trim old data
2. Do not log duplicate data

Figure 6-9. Logging Menu Tab

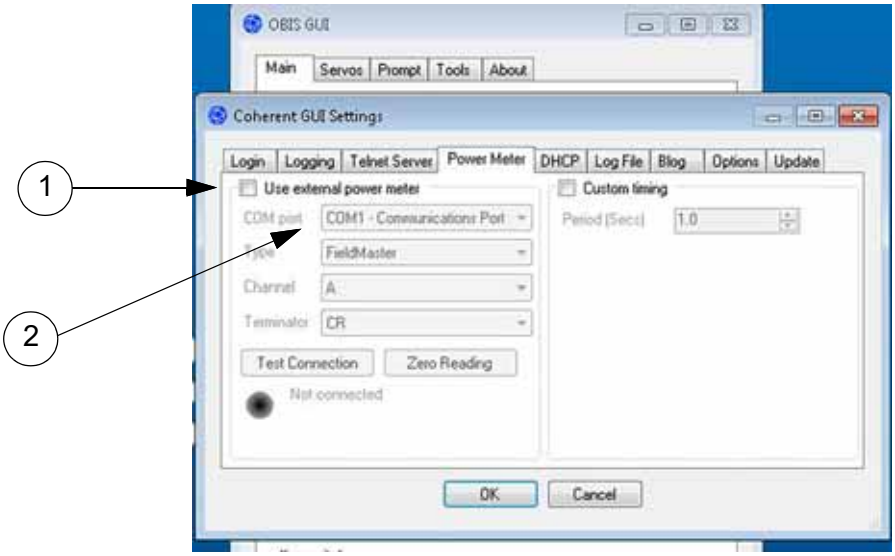
5. Set the data polling frequency by entering a value (m) in the Period (Secs) box. This sets the time period in seconds at which the GUI reads and displays laser parameters. The default value of m is 5; if m is set to zero, the GUI will read the data at the maximum rate.
6. Set the data storing frequency by entering a value in seconds in the Database Period box. This sets the time period in seconds at which the datalogger saves the laser parameters. The default value on the Database Period is 30; if it is set to zero, the GUI will save the data at the maximum rate.
    - The "Period" controls how often data is read from the laser, and the "Database Period" controls how often the data is written into the GUI's database. Therefore if Period = 1 and Database Period = 10 then the GUI will read data once per second, and it will write data to the database once every 10 seconds.
    - Low set values of Period and Database Period may drastically increase the demand for storage space and slow down the speed of data display; high set values may risk skipping data information for brief or intermittent events.

6.5.2 Power Meter

The following instructions for establishing communication with the LabMaster 200 power meter are specific to the LabMaster 200. However, the method used to establish communication for other types of power meters is similar to this method.

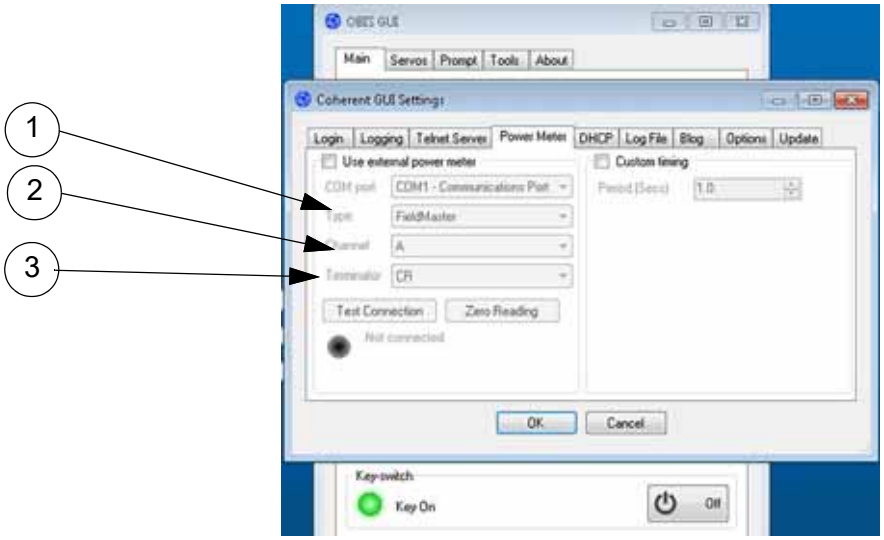
Connect the LabMaster 200 power meter as follows:

1. Connect an RS-232 cable between the power meter and the computer.
2. Make sure the power meter is ON.
3. Click on the Adjust Settings icon at the bottom of the GUI screen.
4. Click on the Power Meter menu tab.
5. Make sure the "Use External Power Meter" check box is checked as shown in Figure 6-10, below.
6. From the COM port dropdown menu, choose the COM port corresponding to the port you connected to the power meter. See Figure 6-10.
7. From the Type dropdown menu, choose the power meter type corresponding to the power meter you are using. See Figure 6-11



1. Use External Power Meter check box
2. COM Port Dropdown menu

Figure 6-10. Power Meter Settings



1. Type Dropdown Menu
2. Channel Dropdown Menu
3. Terminator Dropdown Menu

Figure 6-11. Additional GUI Settings for the Power Meter

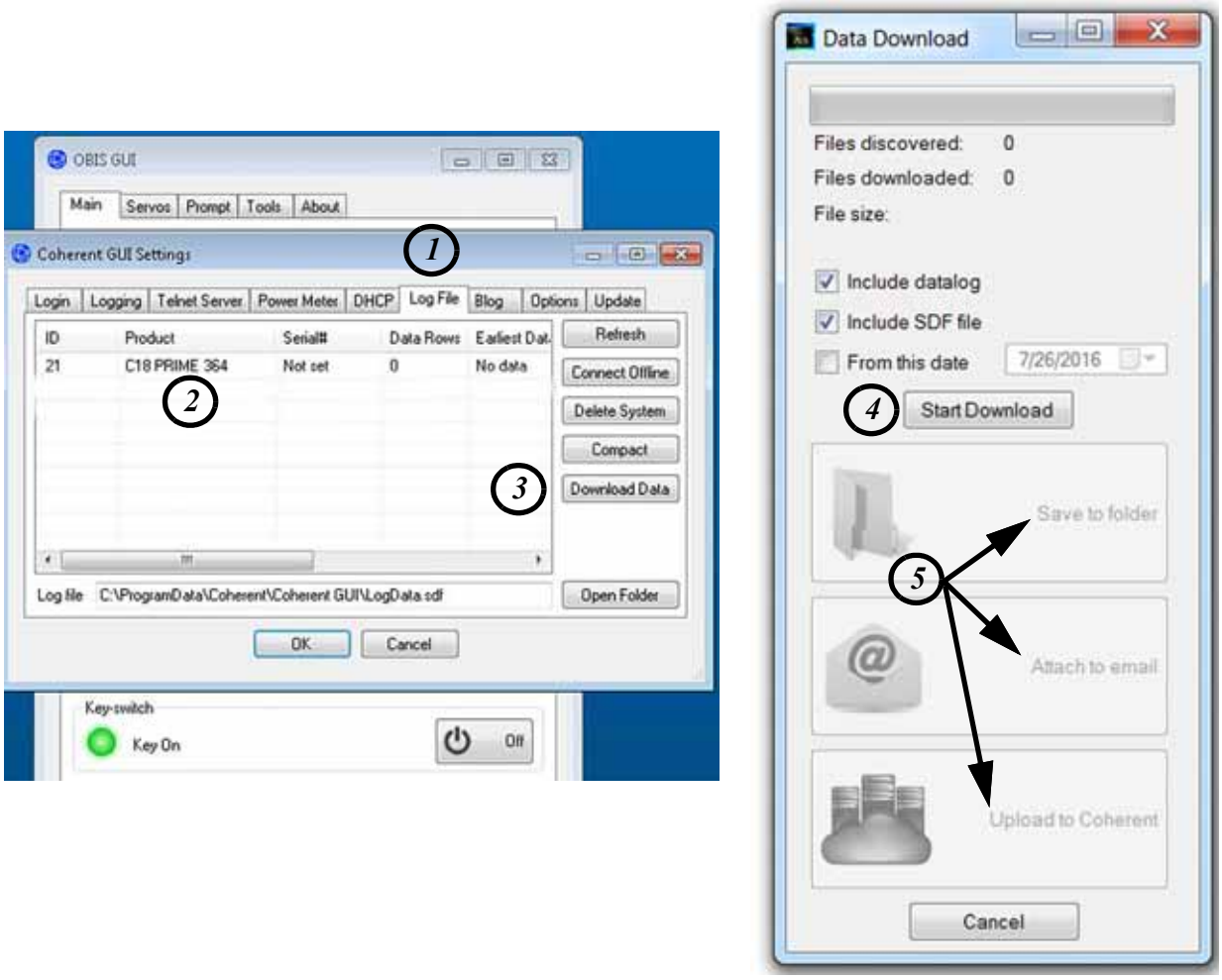
8. From the Channel dropdown menu, choose the channel corresponding to the power meter channel you are using: A or B.
9. From the Terminator dropdown menu, choose the terminator setting that matches the setting on the power meter console.

10. Determine if communication with the power meter has been established by clicking on the Test Connection button.

6.5.3 Log File

The OBIS LG stores data that may be retrieved to evaluate performance or assist in diagnosing a potential problem. Log files can be sent to Coherent product support for diagnostic help. To save the log file, proceed as follows:

1. Connect to the GUI using a USB or Ethernet connection. Do not use RS-232.
2. Click on the Adjust settings icon at the bottom of the GUI screen.
3. Click on the Log File tab as shown in Figure 6-12.
4. Select the active system from the list.
5. Click the Download Data button.
6. The Data Download window will open (see Figure 6-12 on page 61). Click the Start Download button. It may take several minutes to download the file depending on the size. It is preferable to download both the datalog and SDF file, but to reduce the file size the "Include SDF file" button can be de-selected as the datalog is the most important. A message announcing "Done!" will display when the file is finished downloading.
7. Once the file is finished downloading there are three methods to save the Datalog file - save to a folder, attach to an email, or upload to the Coherent Cloud. Click on the chosen method.
8. To save the Datalog file to a folder, click on the "Save to folder" button, and the Save As window opens. The file name will be populated automatically. Then choose the location the file is to be saved and click on the "Save" button. The folder window will open, and can be closed.
9. To send the Datalog file directly to the Coherent Cloud, you must be connected to the internet as well as the laser. Click the "Upload to Coherent" button. A window will open to ask if you wish to include comments.
    a.) Click Yes, and the Blog Post window will open that will allow for any additional information, symptoms, or data to be typed in or attached as additional files.
    b.) Click the Post button when finished. Be patient, the file will take some time to post depending on how large the file is. A dialog box with a link to the Datalog file opens.
    c.) Click the Email URL button. A message window from your email client will open in the background. Click the message title bar to bring it to the front.



1. Log File
2. Choose Active System
3. Download Data
4. Start Download
5. Save DataLog to Folder, Email, or Coherent Cloud

Figure 6-12. Downloading Datalog File

d.) Send this email to product.support@coherent.com.

6.6 Coherent Connection Software

Coherent Connection provides another easy-to-use interface between a Coherent OBIS Laser 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 Coherent Connection software is recommended when operating multiple lasers.

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

Through this 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.

The USB cable is included in the OBIS Laser System. The RS-232 interface can only be accessed through the 26-pin interface. There is no separate connector for RS-232. For information about the RS-232 pin-outs, see Table 4-1 (p. 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.

6.6.1 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

6.6.2 Overview of the Main Tabs

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

Figure 6-13 shows the Operating Power tab. On this page of the software, you can set power levels.

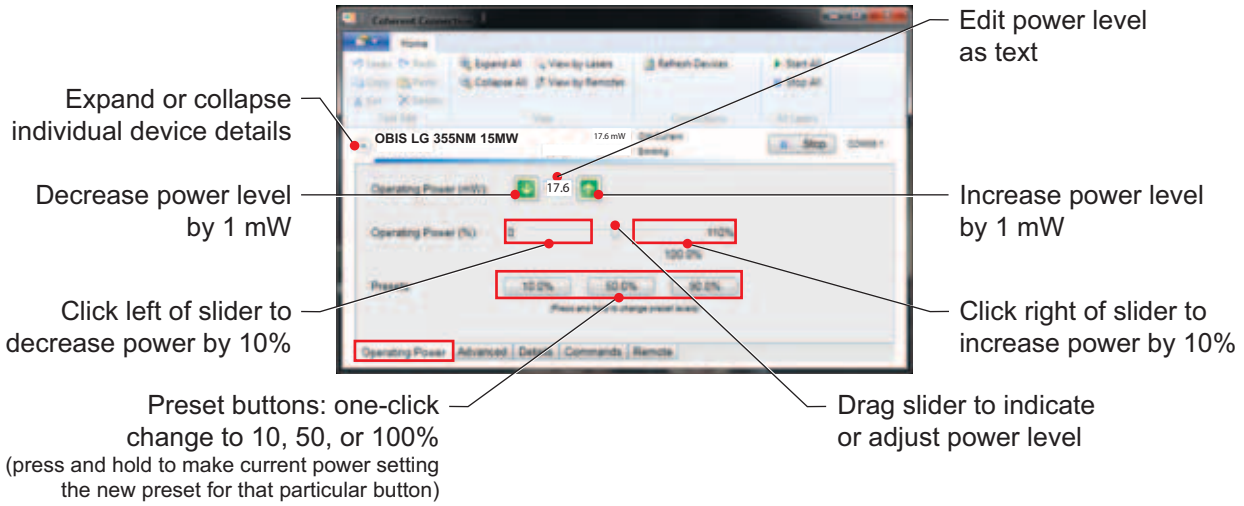


Figure 6-13. Coherent Connection - Operating Power Tab

Figure 6-14 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,

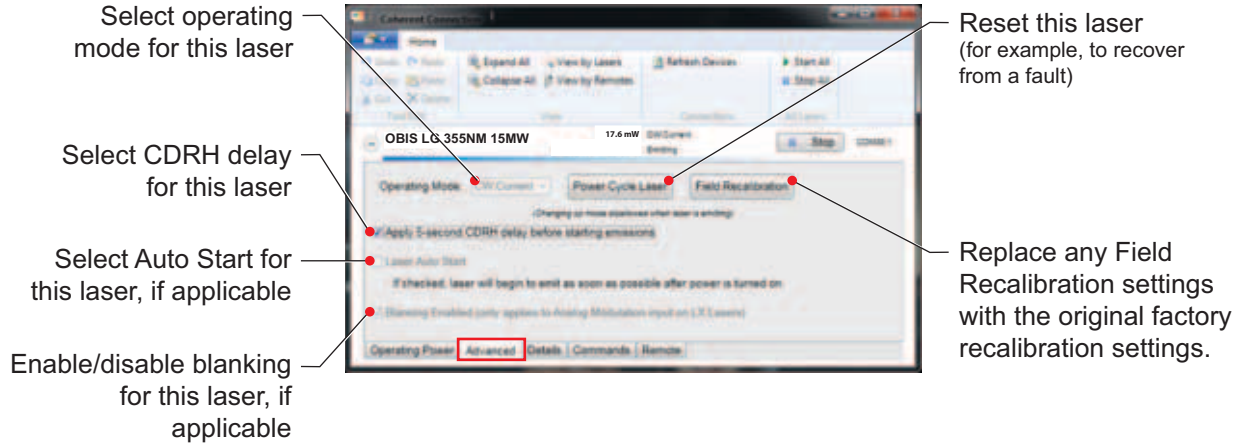


Figure 6-14. Coherent Connection - Advanced Tab

Figure 6-15 shows the Details tab. On this page of the software, you can view the model, serial number, and other information specific to the laser.

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

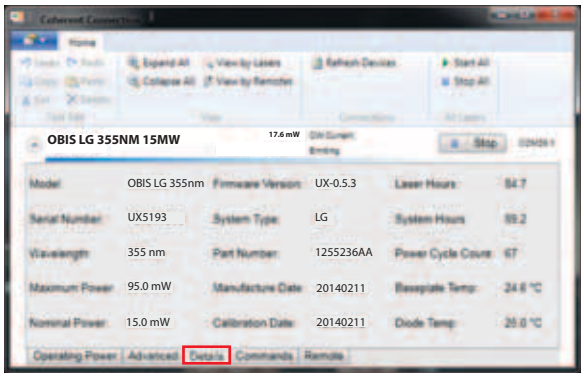


Figure 6-15. Coherent Connection - Details Tab

Figure 6-16 shows the Commands tab. You can view commands and responses, or enter commands to control the laser.

Commands and responses sent to and received from the laser appear in this window

Enter manual commands here

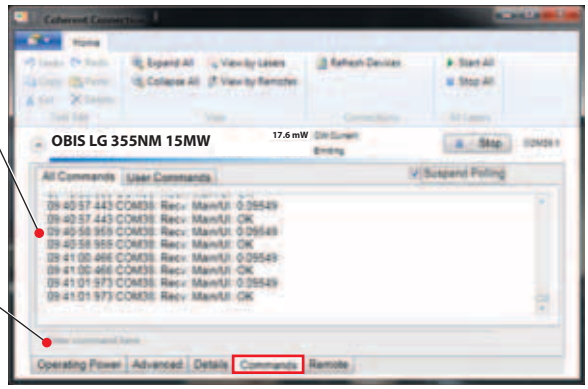


Figure 6-16. Coherent Connection - Commands Tab

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 6-17.

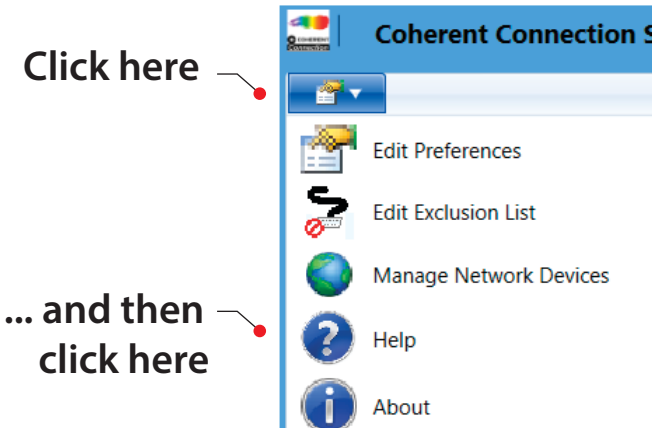


Figure 6-17. Coherent Connection HELP Menu Option

For additional information, go to the Coherent website

7 Host Interface

NOTICE

When a nonvolatile command is sent to the OBIS LG, the parameter for the command is stored in internal nonvolatile memory. The lifetime total number of nonvolatile commands that can be sent to the OBIS LG is >1 million. OBIS commands are nonvolatile except where noted. Compatibility commands are volatile except where noted. All queries are nonvolatile.

7.1 USB and RS-232 Remote Monitor

The communication protocol is the same for the USB and RS-232 connection. See Table 7-1 and Table 7-2 below for the RS-232 communication settings and factory default settings. The RS-232 and USB connections in the HD26 connector can be used simultaneously, but the two USB connectors (mini-B and the pins in the HD 26 connector) cannot be used simultaneously. Commands are executed in the order they are received, with no priority given for any connection. In addition to the OBIS command set, the OBIS LG is backwards-compatible with the HOPS command set (as listed in Table 7-3 (p. 68)).

Table 7-1. RS-232 Communication Settings

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

Table 7-2. Factory Default Settings

Description	Setting
Command prompt	OFF
Command handshake	ON
Laser emission auto start	OFF
CDRH delay	ON
Output power level	Nominal power
Minimum power output limit	0 watts
Virtual keyswitch start-up state	OFF
Maximum power output limit	110% nominal power
Operating mode	CW constant power (CWP)

7.2 Quick Reference

The following table gives a brief description of all host commands and queries. For detailed information about a specific command or query, go to the page referenced in the right-hand column.

Compatibility commands are included to match the command sets of other HOPS products.

Table 7-3. Host Command Quick Reference (Sheet 1 of 5)

Command	Compatibility Command	Description	Pg. No.
IEEE-488.2			
*IDN?		Gets laser identification string	77
*RST		Initiates warm boot	77
*TST?		Runs self-test, if implemented	77
Session Control			
SYSTem:COMMunicate:HANDshaking		Turns handshaking on or off	78
SYSTem:COMMunicate:HAND-shaking?		Gets handshaking setting	78

Table 7-3. Host Command Quick Reference (Sheet 2 of 5)

Command	Compatibility Command	Description	Pg. No.
SYSTem:COMMunicate:PROMpt		Turns communication prompt on or off	78
SYSTem:COMMunicate:PROMpt?		Gets prompt setting	78
SYSTem:AKEY		Turns automatic key on or off	90
SYSTem:AKEY?		Gets automatic key setting	90
SYSTem:AUTostart		Turns auto-start on or off	78
SYSTem:AUTostart?		Gets auto-start setting	78
SYSTem:STATus?		Gets system status	79
SYSTem:FAULt?		Gets system faults	80
SYSTem:INDicator:LASer		Turns the laser head LEDs on or off.	83
SYSTem:INDicator:LASer?		Gets the laser head LEDs setting.	83
SYSTem:ERRor:COUNt?		Gets the number of error records in the error queue	83
SYSTem:ERRor:NEXT?		Gets the next error record in the error queue	84
SYSTem:ERRor:CLEar		Clears all error records in the error queue	84
OBIS LG Common Commands/Queries			
System Information			
SYSTem:INFormation:MODel?		Gets the model name	84
SYSTem:INFormation:MDATe?		Gets the manufacture date	85
SYSTem:INFormation:CDATe?		Gets the calibration date	85
SYSTem:INFormation:SNUMber?	?HID	Gets the laser serial number	85
SYSTem:INFormation:PNUMber?		Gets the laser part number	85
SYSTem:INFormation:FVERsion?	?V	Gets the firmware version	85
SYSTem:INFormation:PVERsion?		Gets the OBIS protocol version	86
SYSTem:INFormation:WAVelength?	?WAVE-LENGTH	Gets the nominal wavelength	86

Table 7-3. Host Command Quick Reference (Sheet 3 of 5)

Command	Compatibility Command	Description	Pg. No.
SYSTem:INFormation:POWer?		Gets the power rating	86
SYSTem:INFormation:TYPe?	?HTYPE	Gets the device type	86
SOURce:POWer:NOMinal?		Gets the nominal output power	86
SOURce:POWer:LIMit:LOW?		Gets the minimum output power	86
SOURce:POWer:LIMit:HIGH?	?PLIM	Gets the maximum output power	87
SYSTem:INFormation:USER		Sets user-defined information in memory	87
SYSTem:INFormation:USER?		Gets user-defined information	87
System State			
SYSTem:CYCLes?		Gets number of electronics on/off power cycles	87
SYSTem:HOURs?	?EEH	Gets total hours that electronics has been powered on	87
SYSTem:DIODe:HOURs?	?HH	Gets total hours that laser diode has operated	88
SOURce:POWer:LEVel?	?P	Gets measured output power from internal power sensor	88
SOURce:CURRent:LEVel?	?C	Gets measured current.	88
SOURce:TEMPerature:BASeplate?	?TBASE	Gets base plate temperature	88
Operational			
SOURce:AM:INTernal	CMODECMD=	Sets the operating mode to internal constant power or constant current.	89
SOURce:AM:SOURce?		Gets the operating mode	89
SOURce:POWer:LEVel:IMMediate:AMPLitude	PCMD=	Sets the power setpoint. This command is volatile in OBIS LG.	89
SOURce:POWer:LEVel:MEMory:AMPLitude	PMEM=	Sets the start-up power setpoint.	89
SOURce:POWer:LEVel:MEMory:AMPLitude?	?PMEM	Gets the start-up power level.	89

Table 7-3. Host Command Quick Reference (Sheet 4 of 5)

Command	Compatibility Command	Description	Pg. No.
SOURce:AM:STATe	KSWCMD=	Turns the laser ON or OFF. This command is not nonvolatile in OBIS LG.	90
SOURce:AM:STATe?	?KSWCMD	Gets the laser on/off state	90
SYSTem:CDRH		Enables or disables the CDRH laser emission delay	90
SYSTem:CDRH?		Gets CDRH laser emission delay setting	90
HOPS-Specific Commands/Queries			
	?HFF	Gets the head 32-bit fault non-latched register	95
	?HFL	Gets the head 32-bit latched register	96
SOURce:TEMPerature:BRF?	?TBRF	Gets the BRF measured temperature	95
SOURce:TEMPerature:SHG?	?TSHG	Gets the SHG measured temperature	96
SOURce:TEMPerature:THG?	?TTHG	Gets the THG measured temperature (UV models only)	96
SOURce:TEMPerature:RESonator?	?TRES	Gets the resonator measured temperature	91
SOURce:TEMPerature:BRF:SERVo:SETPoint?	?TBRFCMD	Gets the BRF setpoint temperature	91
SOURce:TEMPerature:SHG:SERVo:SETPoint?	?TSHGCMD	Gets the SHG setpoint temperature	96
SOURce:TEMPerature:THG:SERVo:SETPoint?	?TTHGCMD	Gets the THG setpoint temperature (UV models)	97
SOURce:TEMPerature:RESonator:SERVo:SETPoint?	?TRESCMD	Gets the resonator setpoint temperature	96
SOURce:TEMPerature:BRF:DRIVer:OUTPut?	?BRFD	Gets the BRF heater output	97
SOURce:TEMPerature:SHG:DRIVer:OUTPut?	?SHGD	Gets the SHG heater output	97

Table 7-3. Host Command Quick Reference (Sheet 5 of 5)

Command	Compatibility Command	Description	Pg. No.
SOURce:TEMPerature:THG:DRIVer:OUTPut?	?THGD	Gets the THG heater output	97
SOURce:TEMPerature:RESonator:DRIVer:OUTPut?	?RESD	Gets the resonator TEC driver output	97
HOPS Compatibility Commands/ Queries			
SOURCE:CURRent:PROTection:LEVel?	?CLIM	Gets the current limit	97
	?CMODECMD	Gets whether the system is commanded to current mode or power mode	98
	?CMODE	Gets whether the system is in current mode or power mode	94
	?FF	Gets the fault code (compatibility format)	98
	?INT	Gets the interlock state	98
	?KSW	Gets the composite key state	98

7.3 Message Considerations

7.3.1 Message Completion Handshake

SCPI (Standard Command for Programmable Instruments) message round trip handshaking is implemented on every message sent by the laser head firmware; however, the handshaking may be disabled using a 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 "ERR<n>\r\n" where <n> represents the error code number. Negative numbers are permitted in the error string.

When handshaking is enabled, OBIS LG devices transmit one of the following handshake reply strings in response to each received command or query:

- Valid commands with valid data parameters 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 "\r\n" and "OK\r\n" string.
- Commands or queries which result in an error reply with "ERR<n>\r\n"
- Unrecognized or unsupported commands or queries reply with "ERR-100\r\n"
- Valid compatibility commands with valid data parameters will reply with "<new value>\r\n"

Note that the message completion handshake is not transmitted in response to a command that has been broadcast to all devices.

Handshaking for compatibility commands do not transmit "OK\r\n", but instead transmit the new value.

7.3.2 Message Terminators

Messages between the OBIS LG 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.

7.3.2.1 Messages Sent to 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.

7.3.2.2 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.

7.3.2.3 Error Record Reporting

If handshaking is disabled, errors that are generated in response to host commands or queries are stored in an error queue. Up to twenty errors can be queued. In the case of overflow, the last error in the queue is an indication of error overflow.

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 queued up to a maximum of 20. In case of error overflow, the last error in the error queue is an indication of error overflow.

7.3.3 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 not required, but 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 use the YYYYMMDD format.

7.3.4 Command Prompt

The OBIS LG can be configured to transmit a command prompt to support interactive operation by a user typing commands into a terminal program. The prompt consists of a '>' character followed by a space character. If the command or query has a response, then the prompt is transmitted after the response. If the command or query has no response, then the prompt is transmitted after the command or query completes.

7.4 Commands and Queries

The OBIS control and query command set confirms to the 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.

The following is a brief description of the notation conventions for the 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 7-4. Supported Commands by Laser Type

Command Set	OBIS LG (HOPS)
SCPI Common Command Set	X
OBIS Common Command Set	X
OBIS LX Extension Command Set	
OBIS LS Extension Command Set	
OBIS LG Extension Command Set	X
HOPS Compatibility Command Set	X

7.4.1 Mandatory Commands and Queries

7.4.1.1 IEEE-488.2 Mandated Commands/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.

7.4.1.1.1 Identification Query

Returns the laser head identification string which is a space-dash-space delimited list consisting of the manufacturer, model, firmware version and firmware date. The first item is always "Coherent, Inc". The second item is the model name which varies based on the laser head. The third field is the firmware version with the format "UX-< major>.<minor>.<revision>.<build>". The fourth field is the firmware date in the YYYYMMDD format.

Query: *IDN?

Response: Coherent, Inc - OBIS LG 355nm 15mW - UX-0.0.0.0 - 20130101

7.4.1.1.2 Reset Command

Executes a warm boot to reset the laser and return it to a known state.The communication handshake, if enabled, is transmitted before executing the reset. This command may be used to clear a fault condition.

Command: *RST

7.4.1.1.3 Self-test Query

Runs a self-test procedure, if implemented. Any detected faults are set in the 32-bit self-test fault code result. A result of 0x00000000 indicates no fault conditions, and a result of 0xFFFFFFFF indicates a self-test is not implemented.

Query: *TST?

Response: <self-test fault code>

7.4.1.2 OBIS Mandatory Commands/Queries

The OBIS Mandatory Command set is implemented by all OBIS compatible devices.

7.4.1.3 Session Control Commands

7.4.1.3.1 Handshaking

Enables/disables handshaking

Nonvolatile: Yes

Factory default: ON

Command: SYSTem:COMMunicate:HANDshaking ON|OFF

Query: SYSTem:COMMunicate:HANDshaking?

Response: ON|OFF

7.4.1.3.2 Command Prompt

Enables/disables command prompt

Nonvolatile: Yes

Factory default: OFF

Command: SYSTem:COMMunicate:PROMpt ON|OFF

Query: SYSTem:COMMunicate:PROMpt?

Response: ON|OFF

7.4.1.3.3 Laser Auto Start

Turns auto-start on or off. If auto-start is enabled, the OBIS LG will automatically start laser emission at a previously set power level after warm-up (always enabled) and CDRH delay (if enabled). The setting is overridden by the external interlock, key switch or other hardware mechanisms. However, the ON/OFF position of the switch will not overwrite the setting in the OBIS LG nonvolatile memory.

Nonvolatile: Yes

Factory default: OFF

Command: SYSTem:AUTostart ON|OFF

Query: SYSTem:AUTostart?

Response: ON|OFF

7.4.1.3.4 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 head. 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. Refer to Status Code Bit Definitions, below, for differences.

The following table 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 Head" 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 head or from a controller

Unspecified bits are reserved and are zero.

Command: None

Query:SYSTem:STATus?

Response: <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)

Table 7-5. Status Code Bit Definitions

Bit	Mask	Name	Description
0	00000001	Laser fault	Laser is in the fault state.
1	00000002	Laser emission	Laser is enabled
2	00000004	Laser ready	Laser is enabled and emitting light within ±2% of setpoint
3	00000008	Laser standby	Laser is in the standby state

Table 7-5. Status Code Bit Definitions (Continued)

4	00000010	CDRH delay	Laser is in the CDRH delay state with the green LED blinking
5	00000020	Laser hardware fault	Any hardware related bit is asserted in SYSTem:FAULt
6	00000040	Laser error	Laser error is queued. SYSTem:ERRor:COUNt is greater than 0.
7	00000080	Laser power calibration	Laser power is within factory calibration specification. Not applicable to OBIS LG. Always 1.
8	00000100	Laser warm-up	Laser is in the warm-up state
9	00000200	Laser head noise	Noise exceeds specification. Not applicable to OBIS LG. Always 0.
10	00000400	External operating mode	External operating mode is selected
11	00000800	Field calibration	Field calibration is in progress. Not applicable to OBIS LG. Always 0.
12	00001000	Laser power voltage	12V laser power voltage is present

All other bits are always zero.

7.4.1.3.5 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.

The MSB of the code is used to indicate if the code represents the status of a controller or a laser head. 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. Refer to the following table for differences.

The following table describes fault code bit mapping.

Command: None

Query: SYSTem:FAULt?

Response: <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)

Table 7-6. Fault Code Bit Definitions (Sheet 1 of 3)

Bit	Mask	Name	Hardware or Software	Description
0	00000001	Base plate temp fault	Hardware	Base plate temperature exceeded 60°C, or there is a short circuit or open circuit.
1	00000002	Diode temp fault	Hardware	Not applicable to OBIS LG because the resonator temperature is controlled
2	00000004	Internal temp fault	Hardware	Not applicable to OBIS LG because the microprocessor temperature sensor is not used for fault checking
3	00000008	Laser power supply fault	Hardware	The 12V power supply to the laser diode driver circuit is not detected
4	00000010	I2C error	Hardware	Not implemented in OBIS LG.
5	00000020	Diode overcur-rent	Hardware	Not applicable because OBIS LG imple-ments a current limit.
6	00000040	Memory checksum error	Hardware	Nonvolatile memory checksum error

Table 7-6. Fault Code Bit Definitions (Sheet 2 of 3)

7	00000080	Checksum recovery performed	Software	Not applicable because OBIS LG cannot recover if calibration data is corrupted
8	00000100	Buffer overflow	Software	The 255 character message receive buffer length was exceeded
9	00000200	Warm-up time limit	Hardware	The 2 minute warm-up time limit was exceeded
10	00000400	TEC driver error	Hardware	Not applicable to OBIS LG
11	00000800	Coherent Connection Bus error	Software	Not applicable to OBIS LG because RS-485 communications over SDR is not supported
12	00001000	Diode temp limit error	Hardware	Not applicable to OBIS LG because the resonator temperature is controlled
13	00002000	Laser ready fault	Hardware	Laser output is enabled, but not within ±2% of setpoint
14	00004000	Photodiode fault	Hardware	Photodiode signal is negative. Not applicable to OBIS LG

Table 7-6. Fault Code Bit Definitions (Sheet 3 of 3)

15	00008000	Fatal fault	Hardware	Irrecoverable system failure. Not implemented in OBIS LG
16	00010000	Start-up fault	Hardware	Errors occurred during start-up. Not implemented in OBIS LG
17	00020000	Watchdog timer reset	Software	Firmware restarted due watchdog timer reset
18	00040000	Field calibration error	Hardware	Not applicable because OBIS LG does not support field calibration
20	00100000	Laser overpower fault	Hardware	Not applicable because OBIS LG implements a power limit

All other bits are always 0.

7.4.1.3.6 Turn On/Off Laser Status Indicator

Enables the red, yellow and green status indicators on the laser head.The status bits returned by SYSTem:STATus? are not affected by the setting. The indicators on the OBIS LG cannot be turned off. This mandatory command is included for compatibility with the OBIS family.

Nonvolatile: Yes

Factory default: ON

Command: SYSTem:INDicator:LASer ON|OFF

Query: SYSTem:INDicator:LASer?

Response: ON|OFF

7.4.1.3.7 Error Count Query

Returns the number of error records in the error queue.

Query: SYSTem:ERRor:COUNt?

Response: <integer count of error records stored>

7.4.1.3.8 Error Query

Gets the next error record(s) in the error queue. More than one error record may be queried using the optional <error record count> parameter, which must be an integer value. A single error record is returned if <error record count> is not specified. 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

Command: none

Query: SYSTem:ERRor:NEXT? {<n>}

Response: <next available error record, if any>

7.4.1.3.9 Clear All Errors

Clears all error records in the error queue.

Command: SYSTem:ERRor:CLEar

7.4.2 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.

7.4.2.1 System Information Queries

The System Information commands allow a host to retrieve static information describing the characteristics of the laser.

7.4.2.1.1 System Model Name Query

Returns the model name.

Query: SYSTem:INFormation:MODel?

Response: <model name>

7.4.2.1.2 System Manufacture Date Query

Returns the manufacture date.

Query: SYSTem:INFormation:MDATe?

Response: <manufacture date in YYYYMMDD format>

7.4.2.1.3 System Calibration Date Query

Returns the calibration date.

Query: SYSTem:INFormation:CDATe?

Response: <calibration date in YYYYMMDD format>

7.4.2.1.4 System Serial Number Query

Returns the serial number.

Query: SYSTem:INFormation:SNUMber?

Response: <serial number>

7.4.2.1.5 System Part Number Query

Returns the part number.

Query: SYSTem:INFormation:PNUMber?

Response: <manufacturer part number>

7.4.2.1.6 System Firmware Version Query

Returns the firmware version using the same format as in *IDN?

Query: SYSTem:INFormation:FVERsion?

Response: <firmware version>

7.4.2.1.7 System Protocol Version Query

Returns the OBIS protocol version in the format "P<major>.<minor><optional qualifier characters>".

Example: "P1.10"

Query: SYSTem:INFormation:PVERsion?

Response: <OBIS protocol version>

7.4.2.1.8 System Wavelength Query

Returns the nominal wavelength in nanometers.

Query: SYSTem:INFormation:WAVelength?

Response: <wavelength>

7.4.2.1.9 System Power Rating Query

Returns the power rating in watts. This is the same as the nominal power.

Query: SYSTem:INFormation:POWer?

Response: <x.xxxxxx>

7.4.2.1.10 Device Type Query

Returns the device type.

Query: SYSTem:INFormation:TYPe?

Response: LG

7.4.2.1.11 CW Nominal Power Query

Returns the nominal laser output power in watts. This is the same as the power rating.

Query: SOURce:POWer:NOMinal?

Response: <x.xxxxxx>

7.4.2.1.12 CW Minimum Power Query

Returns the minimum laser output power in watts.

Query: SOURce:POWer:LIMit:LOW?

Response: <x.xxxxxx>

7.4.2.1.13 CW Maximum Power Query

Returns the maximum laser output power in watts.

Query: SOURce:POWer:LIMit:HIGH?

Response: <x.xxxxxx>

7.4.2.1.14 Set/Query User-Defined ID

Stores user-defined information in nonvolatile memory. The user can enter up to four items with index from 0 to 3 with each item containing up to 31 characters.

Nonvolatile: Yes

Command: SYSTem:INFormation:USER <index>, <item>

Query: SYSTem:INFormation:USER? <index>

Response: Item stored at the location pointed to by <index>

7.4.2.2 System State Commands/Queries

System State commands allow a host to retrieve dynamic information describing the current operational state of the laser.

7.4.2.2.1 System Power Cycle Query

Returns the number of ON/OFF power cycles the laser has endured.

Query: SYSTem:CYCLes?
Reply: <integer cycle count>

7.4.2.2.2 System Power Hour Query

Returns the accumulated operating hours which is the time the OBIS LG has been powered on.

Query: SYSTem:HOURs?
Reply: <value in x.xxxx format>

7.4.2.2.3 Diode Hour Query

Returns the accumulated laser emission hours which is the time laser enable signal is asserted.

Query: SYSTem:DIODe:HOURs?
Reply: <value in x.xxxx format>

7.4.2.2.4 System Output Power Level Query

Returns the output power in watts measured with the internal power sensor.

Query: SOURce:POWer:LEVel?

Response: <x.xxxxxx>

7.4.2.2.5 System Output Current Query

Returns the laser current in amps

Query: SOURce:POWer:CURRent?

Response: <x.xxx>

7.4.2.2.6 Base Plate Temperature Query

Returns the base plate temperature in °C

Query: SOURce:TEMPerature:BASeplate?

Response: <x.xxx>

7.4.2.3 Operational Commands/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.

7.4.2.3.1 Laser Operating Mode Selection

The OBIS LG supports two mutually exclusive operating modes.

- CWP (continuous wave, constant power)

- CWC (continuous wave, constant current)

7.4.2.3.2 Select CW Mode

Sets the laser operating mode to internal CW and deselects external modulation. The setting is saved in non-volatile memory.

Nonvolatile: Yes

Default: CWP

Command: SOURce:AM:INTernal CWP|CWC

7.4.2.3.3 Laser Operating Mode Query

Gets the operating mode.

Query: SOURce:AM:SOURce?

Response: CWP|CWC

7.4.2.3.4 Set/Get Laser Power Level

Sets laser power setpoint in watts.

Nonvolatile: No. OBIS LG differs from other OBIS products in that this command is volatile.

Command: SOURce:POWer:LEVel:IMMediate:AMPLitude <value>

Query: SOURce:POWer:LEVel:IMMediate:AMPLitude?

Response: <x.xxxxxx>

7.4.2.3.5 Set/Get Laser Power Memory Level

Sets the start-up value of the power setpoint in watts. This command does not change the immediate power setpoint.

Nonvolatile: Yes.

Command: SOURce:POWer:LEVel:MEMory:AMPLitude <value>

Query: SOURce:POWer:LEVel: MEMory:AMPLitude?

Response: <x.xxxxxx>

7.4.2.3.6 Set/Get Laser Enable

Turns laser emission on or off. When turning the laser on, laser emission may be delayed by internal electronics, firmware and/or the CDRH delay.

Nonvolatile: No.

Command: SOURce:AM:STATe ON|OFF

Query: SOURce:AM:STATe?

Response: ON|OFF

7.4.2.3.7 Set/Query CDRH Delay

NOTICE

Disabling the CDRH delay will render the OBIS-LG non-CDRH compliant.

Turns the CDRH five-second laser emission delay on or off.

Nonvolatile: Yes

Factory default: On

Command: SYSTem:CDRH ON|OFF

Query: SYSTem:CDRH?

Response: ON|OFF

7.4.3 OBIS LG Commands

The commands in this section apply to OBIS LG

7.4.3.0.1 Set/ Query Automatic Key

Store or query the start-up value of SOURce:AM:STATe. Note that if SYSTem:AUTostart is ON, SOURce:AM:STATe is set to ON regardless of the value of SYSTem:AKEY

Nonvolatile: Yes

Factory default: Off

Command: SYSTem:AKEY ON|OFF

Query: SYSTem:AKEY?

Response ON|OFF

7.4.3.0.2 Resonator Temperature Query

Returns the resonator measured temperature in °C. Resonator temperature is the same as main or diode temperature.

Query: SOURce:TEMPerature:RESonator?

Response: <x.xxx>

7.4.3.0.3 BRF Temperature Query

Returns the BRF measured temperature in °C.

Query: SOURce:TEMPerature:BRF?

Response: <x.xxx>

7.4.3.0.4 SHG Temperature Query

Returns the SHG measured temperature in °C.

Query: SOURce:TEMPerature:SHG?

Response: <x.xxx>

7.4.3.0.5 THG Temperature Query

Returns the THG measured temperature in °C. UV models only.

Query: SOURce:TEMPerature:THG?

Response: <x.xxx>

7.4.3.0.6 Resonator Setpoint Temperature Query

Returns the resonator setpoint temperature in °C. Resonator temperature is the same as main or diode temperature.

Query: SOURce:TEMPerature:RESonator:SERVo:SETPoint?

Response: <x.xxx>

7.4.3.0.7 BRF Setpoint Temperature Query

Returns the BRF setpoint temperature in °C.

Query: SOURce:TEMPerature:BRF:SERVo:SETPoint?

Response: <x.xxx>

7.4.3.0.8 SHG Setpoint Temperature Query

Returns the SHG setpoint temperature in °C.

Query: SOURce:TEMPerature:SHG:SERVo:SETPoint?

Response: <x.xxx>

7.4.3.0.9 THG Setpoint Temperature Query

Returns the THG setpoint temperature in °C. UV models only.

Query: SOURce:TEMPerature:THG:SERVo:SETPoint?

Response: <x.xxx>

7.4.3.0.10 Resonator TEC Driver Output Query

Returns the resonator TEC driver output in volts. Resonator temperature is the same as main or diode temperature.

Query: SOURce:TEMPerature:RESonator:DRIVer:OUTPut?

Response: <x.xxx>

7.4.3.0.11 BRF Heater Output Query

Returns the BRF heater output in nominal volts.

Query: SOURce:TEMPerature:BRF:DRIVer:OUTPut?

Response: <x.xxx>

7.4.3.0.12 SHG Heater Output Query

Returns the SHG heater output in nominal volts.

Query: SOURce:TEMPerature:SHG:DRIVer:OUTPut?

Response: <x.xxx>

7.4.3.0.13 THG Heater Output Query

Returns the THG heater output in nominal volts. UV models only.

Query: SOURce:TEMPerature:THG:DRIVer:OUTPut?

Response: <x.xxx>

7.4.4 OBIS-LG Compatibility Commands

The commands in this section apply to OBIS-LG. These commands are included for compatibility with other HOPS products. All commands are volatile except where noted.

7.4.4.0.1 System Serial Number Query

Returns the serial number.

Query: ?HID

Response: <serial number>

7.4.4.0.2 CW Maximum Power Query

Returns the maximum laser output power in watts.

Query: ?PLIM

Response: <x.xxxxxx>

7.4.4.0.3 System Power Hour Query

Returns the accumulated powered-on hours

Query: ?EEH

Response: <x.xxxx>

7.4.4.0.4 Diode Hour Query

Returns the accumulated laser emission hours

Query: ?HH

Response: <x.xxxx>

7.4.4.0.5 System Output Power Level Query

Returns the output power in watts measured with the internal power sensor.

Query: ?P

Response: <x.xxxxxx>

7.4.4.0.6 System Output Current Query

Returns the laser current in amps

Query: ?C

Response: <x.xxx>

7.4.4.0.7 Base Plate Temperature Query

Returns the base plate temperature in °C

Query: ?TBASE

Response: <x.xxx>

7.4.4.0.8 Set/Query Current Mode Command

Returns whether the current/power mode control is set for power mode (0) or current mode (1)

Query: ?CMODECMD
Command: CMODECMD=0|1

Response: 0|1

7.4.4.0.9 Current Mode Query

Returns whether the current/power mode control is in power mode (0) or current mode (1).

Query: ?CMODE

Response: 0|1

7.4.4.0.10 Set/Query Laser Power Level

Sets laser power setpoint in watts.

Nonvolatile: No.

Command: PCMD=<value>

Query: ?PCMD

Response: <x.xxxxxx>

7.4.4.0.11 Set/Query Laser Power Memory Level

Sets the start-up value of the power setpoint in watts. This command does not affect the PCMD= value

Nonvolatile: Yes.

Command: PMEM=<value>

Query: ?PMEM

Response: <x.xxxxxx>

7.4.4.0.12 Set/Query Laser Enable

Turns laser emission on or off. When turning the laser on, actual laser emission may be delayed by electronics, firmware and/or the CDRH delay.

Nonvolatile: No.

Command: KSWCMD=0|1

Query: ?KSWCMD

Response: 0|1

7.4.4.0.13 Resonator Temperature Query

Returns the resonator measured temperature in °C. Resonator temperature is the same as main or diode temperature.

Query: ?TMAIN

Response: <x.xxx>

7.4.4.0.14 BRF Temperature Query

Returns the BRF measured temperature in °C.

Query: ?TBRF

Response: <x.xxx>

7.4.4.0.15 SHG Temperature Query

Returns the SHG measured temperature in °C.

Query: ?TSHG

Response: <x.xxx>

7.4.4.0.16 THG Temperature Query

Returns the THG measured temperature in °C. UV models only.

Query: ?TTHG

Response: <x.xxx>

7.4.4.0.17 Resonator Setpoint Temperature Query

Returns the resonator setpoint temperature in °C. Resonator temperature is the same as main or diode temperature.

Query: ?TMAINCMD

Response: <x.xxx>

7.4.4.0.18 BRF Setpoint Temperature Query

Returns the BRF setpoint temperature in °C.

Query: ?TBRFCMD

Response: <x.xxx>

7.4.4.0.19 SHG Setpoint Temperature Query

Returns the SHG setpoint temperature in °C.

Query: ?TSHGCMD

Response: <x.xxx>

7.4.4.0.20 THG Setpoint Temperature Query

Returns the THG setpoint temperature in °C. UV models only.

Query: ?TTHGCMD

Response: <x.xxx>

7.4.4.0.21 Resonator TEC Driver Output Query

Returns the resonator TEC driver output in volts. Resonator temperature is the same as main or diode temperature.

Query: ?MAIND

Response: <x.xxx>

7.4.4.0.22 BRF Heater Output Query

Returns the BRF heater output in nominal volts.

Query: ?BRFD

Response: <x.xxx>

7.4.4.0.23 SHG Heater Output Query

Returns the SHG heater output in nominal volts.

Query: ?SHGD

Response: <x.xxx>

7.4.4.0.24 THG Heater Output Query

Returns the THG heater output in nominal volts. UV models only.

Query: ?THGD

Response: <x.xxx>

7.4.4.0.25 Current Limit Query

Gets the current command limit

Query: ?CLIM

Response: <x.xxx>

7.4.4.0.26 Composite Keyswitch State Query

Returns the overall keyswitch state which is 1 if both the physical and virtual keyswitches are closed and 0 if either or both are open.

Query: ?KSW

Response: 0|1

7.4.4.0.27 Interlock State Query

Returns the interlock state which is 1 if the interlock is closed and 0 if the interlock is open

Query: ?INT

Response: 0|1

7.4.4.0.28 Compatibility Fault Query

Returns 16-bit fault code defined in Table 7-7.

Query: ?FF

Response: <16-bit fault code>

Table 7-7. ?FF Fault Codes

Code Bit	Error Value	Error Description
3	0008	Resonator temperature out-of-range
4	0010	BRF, SHG, or THG temperature out of range
5	0020	The interlock is open. The yellow LED is off
9	0200	System fault. The red LED is on.
11	0800	System at current limit. The OBIS LG is not able to produce the required power at the maximum allowed current.

7.5 Differences from Other OBIS Lasers

This section highlights some differences between OBIS LG and other OBIS lasers for users who may be using other OBIS lasers:

1. OBIS LG does not store the value of SOURce:POWer:LEVel:IMMediate:AMPLitude in nonvolatile memory. SOURce:POWer:LEVel:MEMory:AMPLitude is provided to store the start-up value of SOURce:POWer:LEVel:IMMediate:AMPLitude in nonvolatile memory.
2. OBIS LG does not store the value of SOURce:AM:STATe in nonvolatile memory. SYSTem:AKEY is provided to store the start-up value of SOURce:AM:STATe in nonvolatile memory. However, if SYSTem:AUTostart is ON it will set SOURce:AM:STATe to ON regardless of the value of SYSTem:AKEY.
3. OBIS LG does not support Fahrenheit temperatures. All temperature values are in Celsius.
4. The OBIS LG baseplate fault is latching - user intervention is necessary before the laser will turn on even after the baseplate fault condition has gone away. The fault occurs if the baseplate temperature rises above 60°C. The fault cannot be cleared until the baseplate temperature drops below 30°C. After the baseplate has cooled down, to clear the fault the laser enable must be cycled – KSWCMD=0 – KSWCMD=1 – KEYSWCMD=0. Note: if the fault was caused by an open or shorted sensor, the fault cannot be cleared and the laser must be returned for to the factory for service.

8 Maintenance and Service

WARNING!
Do not open the OBIS LG laser subsystem. There are no user-serviceable components or adjustments inside. There are hazardous levels of laser energy inside the laser head.

8.1 Technical Support

Should you experience any difficulties with your laser or need any technical information, please go to our web site www.Coherent.com. Should you need further assistance, please contact Coherent Technical Support by e-mail customer.support@coherent.com or telephone, 1-734-456-3100. Please be prepared to supply the model and laser head serial number of your laser system, the description of the problem, and any attempted corrective steps to the Product Support Engineer responding to your request.

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

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

8.2 Fault Troubleshooting

Table 8-1 lists fault codes and descriptions for troubleshooting the OBIS LG laser system. The condition that caused a system fault can be determined by using the ?HFL query. The ?HFF query returns the head fault register (faults active at the time of the query). ?HFL returns the latched version of the register (faults that have been active at any time since the laser completed warm up, or the latch was cleared).

The head fault register is 32 bits long, and each bit corresponds to a different fault. The laser responds to the queries in hexadecimal format to make it easy to identify which bits are active. Each digit in the response can take values from 0 to F corresponding to the state of a group of 4 bits in the register. The head fault register values in Table 8-1 below are listed as if they are the only fault active. In the laser response their values add if more than one of them is active.

For example a response of 0x0000000A indicates temperature faults in the etalon (0x00000008) and SHG (0x00000002) are active.

Before contacting Coherent Service, generate a log file for analysis as outlined in "Check V? to determine firmware level. If firmware is prior to 0.5.5.27, contact Coherent Service for a firmware upgrade." (p. 105).

Table 8-1. Fault Lookup Table

Head Fault Register	Name	Suggested Action
0x00000001	BRF Temp Fault	Contact Coherent Service
0x00000002	SHG Temp Fault	Contact Coherent Service
0x00000004	THG Temp Fault	Contact Coherent Service
0x00000008	Etalon Temp Fault	Contact Coherent Service
0x00000010	Resonator Temp Fault	See "Resonator Temperature Fault" (p. 102)
0x00000100	Heatsink Temp Fault	See "Heat Sink Temperature Fault" (p. 103)
0x00000200	Internal Temp Fault	See "Internal Temperature Fault" (p. 105)
0x00010000	LDD Fault	See "LDD Fault" (p. 105)
0x00020000	Shutter Fault	Contact Coherent Service
0x01000000	Head Memory Fault	Contact Coherent Service
0x02000000	Board Memory Fault	Contact Coherent Service
0x20000000	Warm-up Timeout	See "Warm-up Timeout" (p. 105)

8.2.1 Resonator Temperature Fault

Head Fault Register:: 0x00000010
Definition: The resonator temperature has reached 27.0°C.

Suggested Actions (see Figure 8-1):

1. Confirm that the heat sink is functioning properly. For an air cooled heat sink, check if the cooling fan is working properly. For a water cooled heat sink, check that the water is flowing without any restrictions
2. Confirm that the thermal interface pad was installed when the laser was mounted to the heat sink.
3. Check the performance of the heat sink (See “Heat Sink Design Guidelines (For Use with Non-Coherent Heatsink)” (p. 33)). If the thermal impedance of the heat sink is too high a different heat sink may be required.
4. Check that the laser mounting screws are tightened to the correct torque (See “Mechanical / Thermal Interface” (p. 32)). If not then remount the laser using the correct torque on the screws.
5. Confirm that the ambient air temperature is within operating specifications, 10 - 40 °C (50-104°F).

8.2.2 Heat Sink Temperature Fault

Head Fault Register: 0x00000100
Definition: The laser heat sink has reached 60°C.

NOTICE
This fault latches, and can only be cleared by cycling the DC power to the laser or by means of a system re-start command (z!).

Suggested Actions (see Figure 8-1):

1. Confirm that the heat sink is functioning properly. For an air cooled heat sink, check if the cooling fan is working properly. For a water cooled heat sink, check that the water is flowing without any restrictions
2. Confirm that the thermal interface pad was installed when the laser was mounted to the heat sink.
3. Check the performance of the heat sink (See “Heat Sink Design Guidelines (For Use with Non-Coherent Heatsink)” (p. 33)). If the thermal impedance of the heat sink is too high a different heat sink may be required.
4. Check that the laser mounting screws are tightened to the correct torque (See “Mechanical / Thermal Interface” (p. 32)). If not then remount the laser using the correct torque on the screws.
5. Confirm that the ambient air temperature is within operating specifications, 10 - 40 °C (50-104°F).

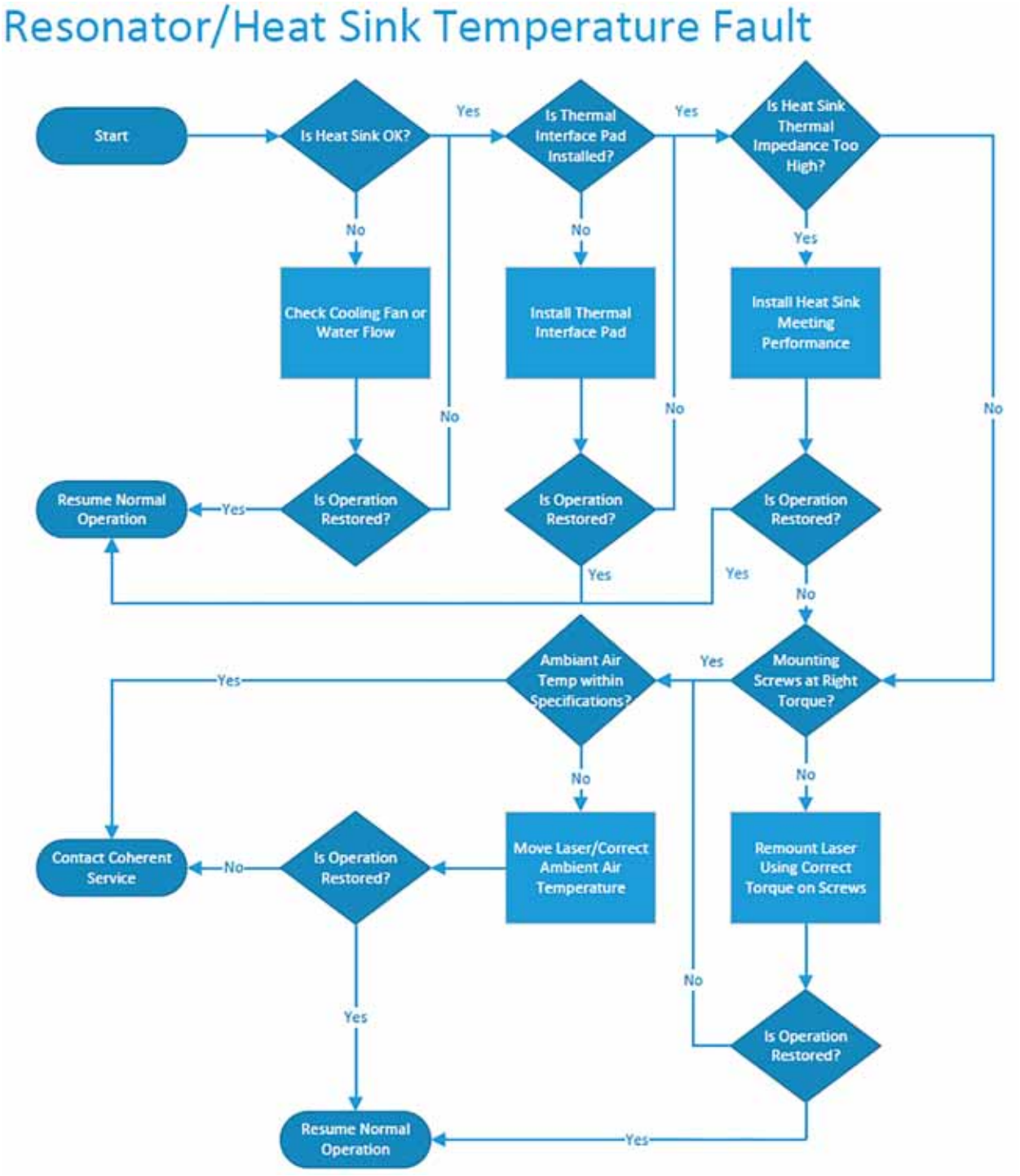


Figure 8-1. Resonator/Heat Sink Temperature Faults

8.2.3 Internal Temperature Fault

Head Fault Register:: 0x00000200
Definition: The microprocessor temperature is outside of operating range.

Suggested Actions:

1. Power down the laser and let the system come to room temperature before trying to start again.

8.2.4 LDD Fault

Head Fault Register:: 0x00010000
Definition: The diode driver inside the laser head has faulted.

Suggested Actions:

1. Check the laser is properly attached to the heat sink. Check that the laser mounting screws are tightened to the correct torque (See “Mechanical / Thermal Interface” (p. 32)). If not then remount the laser using the correct torque on the screws.

8.2.5 Warm-up Timeout

Head Fault Register:: 0x20000000
Definition: All crystal temperatures are not within specified limits within two minutes from power on.

Suggested Actions:

1. Confirm that the ambient air temperature is within operating specifications, 10 - 40 °C (50-104°F).
2. Check V? to determine firmware level. If firmware is prior to 0.5.5.27, contact Coherent Service for a firmware upgrade.

8.2.6 Downloading the Log File

Log files can be sent to Coherent product support for diagnostic help. To save the log file, proceed as follows:

1. Open the Coherent GUI (see Figure 8-2).
2. Open the GUI Settings tab (bottom right) and then go to the “Log File” tab (see Figure 8-3).

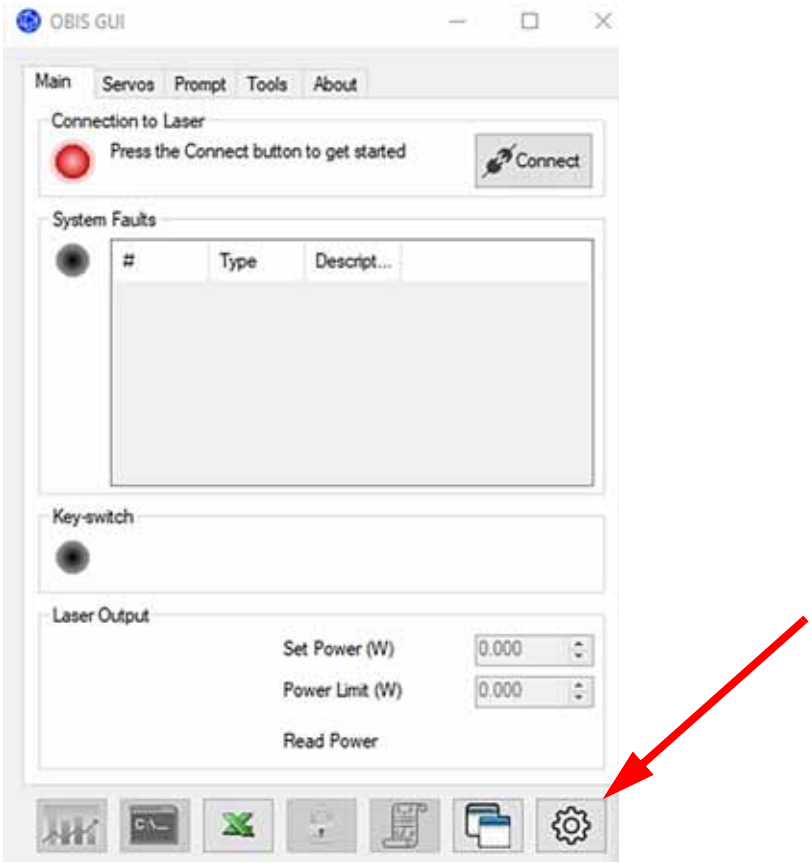


Figure 8-2. Open the GUI

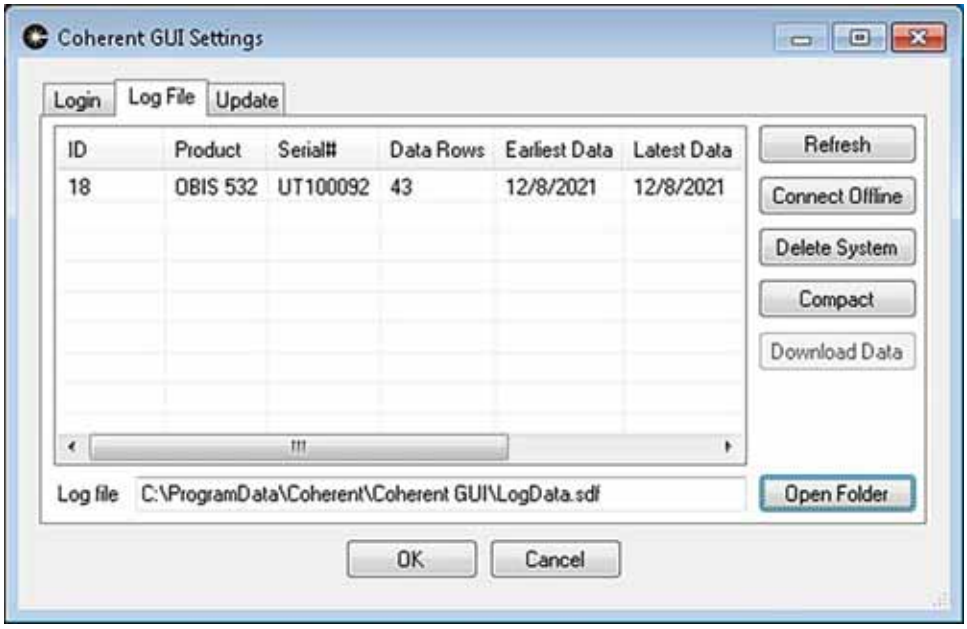


Figure 8-3. Log File Tab

3. Press the “Open Folder” button, then find the “LogData.sdf” file in that folder and send to Coherent (see Figure 8-4).

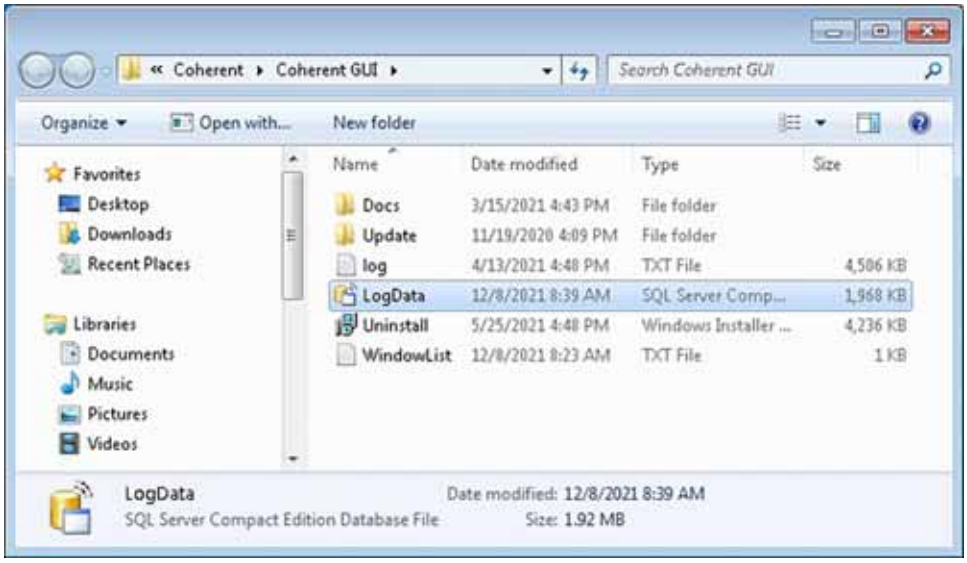


Figure 8-4. Find Log Data File

I Parts List and Accessories

I.1 Parts List

Table I-1. Parts List

Description	Part Number
OBIS LG Power Supply Kit (OEM)	1285630
OBIS LG Air-Cooled Riser Option (UV Only)	1284288
OBIS LG Power to Laser Cable Assembly, HD26 Pin	1260035
USB A to Mini-B Cable Assembly, 1.8m Length, Black	1265736
OBIS Thermal Pad, U90, 0.2mm Thick, Silicone Free	1314352

I.2 Accessories

The following is a list of recommended power meters for use with the OBIS LG.

Table I-2. Recommended Power Meters

Description	Name	Part Number
Thermopile sensor for 10mW to 10W with beam position sensing, 0.25 to 10.6 um spectral range (16mm aperture).	LM-10	1098304
Low power thermopile sensor up to 3W with 50µW resolution (19mm aperture) (RoHS)	PM3	1098336
Low power thermopile sensor up to 3W with 50µW resolution with quartz filter (10mm aperture) (RoHS)	PM3Q	1098419
Low power thermopile sensor up to 1W with 10µW resolution (10mm aperture) (RoHS)	PS10	1098350
Low power thermopile sensor up to 1W with 10 µW resolution with quartz filter (10 mm aperture) (RoHS)	PS10Q	1098400

Table I-2. Recommended Power Meters

Low power thermopile sensor up to 1W with 10 µW resolution with quartz filter (19 mm aperture) (RoHS)	PS19	1098413
Low power thermopile sensor up to 1W with 10 µW resolution with quartz filter (19 mm aperture) (RoHS)	PS19Q	1098341

II Packing Procedures

II.1 Packing Procedure

In the event that a system needs to be shipped back for service, it must be packed properly in order to avoid damage that may occur during shipping.

1. Key off and power off the laser and unplug the 24V power to the system.

Use static control precautions before disconnecting diode cable.

2. Disconnect all cables. Close shutter.
3. Place all the cables in bag and secure with tape.
4. Wrap the laser head (with heatsink if used) in the PE bag provided and secure with tape (see Figure II-1 below).

Figure II-1. Laser Head with Heatsink

5. Place the laser head and components in the shipping box in the proper orientation shown in Figure II-2.
6. Confirm the orientation of the upper packing foam is correct and place on top of the laser head and the controller.
7. Include necessary paperwork for return shipment. Contact Coherent Service (1-800-367-7890) for RMA information.

1. Power Supply
2. Laser Head
3. Cable Assembly, Obis Power to Laser, HD 26 Pin
4. Power Supply Cables
5. USB Cable

Figure II-2. Laser Orientation in Shipping Box

8. Close and seal box with tape. Apply appropriate shipping label and ship back to Coherent using company approved freight vendor.

III Warranty

III.1 Warranty

Coherent, Inc. warrants the OBIS LG Laser to the original purchaser (the Buyer) only. Coherent warrants 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.

For specific warranty terms and conditions for your OBIS LG laser system, refer to your sales contract.

III.2 Conditions of Warranty

For warranty service requiring the return of any product to Coherent, the product must be returned to a service facility designated by Coherent. The Buyer is responsible for all shipping charges, taxes and duties.

Parts replaced under warranty shall become the property of Coherent and must be returned to Coherent, Inc., Santa Clara, or to a facility designated by Coherent. All laser systems must be carefully packed in a suitable shipping container(s). Coherent does not assume responsibility for components broken in shipment due to improper packaging or handling. The Buyer will be obligated to issue a purchase order for the value of the replaced parts and Coherent will issue credit when the parts are received.

III.3 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.

In the event of warranty repair, the Buyer is responsible for packing the unit in the original shipping container. If warranty returns are packed improperly, the warranty may be voided.

III.4 Limitations of Warranty

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

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

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

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

Glossary

°C	Degrees centigrade or Celsius
°F	Degrees Fahrenheit
µ	Microns
µrad	Microradian(s)
µsec	Microsecond(s)
$1/e^2$	Beam diameter parameter
A	Amperes
AC	Alternating current
Amp(s)	Amperes
CDRH	Center for Devices and Radiological Health
CFR	Code of Federal Regulation
cm	Centimeter(s)
DC	Direct current
EEPROM	Electrically erasable programmable read only memory
EMC	Electromagnetic Compliance
FAP-I™	Fiber array package-integrated
FSR	Free spectral range
I/O	Input/output
kg	Kilogram(s)
LD	Laser diode
LED	Light emitting diode
LVD	Low Voltage Directive
m	Meter(s)
mA	Milliampere(s)
MHz	Megahertz
mm	Millimeter(s)
mrad	Milliradian(s)
ms	Millisecond(s)
mV	Millivolt(s)
mW	Milliwatt(s)
Nd:YAG	Neodymium:Yttrium Aluminum Garnet
$Nd:YVO_4$	Neodymium:Yttrium Orthovanadate
nm	Nanometer(s)
OEM	Original equipment manufacturer
RMS	Root mean square
SCPI	Standard Commands for Programmable Instruments
TEC	Thermo-electric cooler
TEM	Transverse Electromagnetic Mode (cross-sectional laser beam mode)
VAC	Volts, alternating current

VDC	Volts, direct current
W	Watt(s)

Index

OBIS LG Integrator's Manual

Part No.1263430, Rev. AC

COHERENT

INNOVATIONS THAT RESONATE

1263430 AB

OBIS LG Laser Systems Integrator's Manual

Part No. 1263430 Rev. AC