Integrator's Manual
OBIS LG
Laser Systems

COHERENT.
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Patents referenced in this manual are active when the manual is printed (see last page for date). You are advised to check to see if the patents are still active **http://portal.uspto.gov/external/portal/pair**.

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In the U.S.:

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

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

Outside the U.S.:

If you are located outside the U.S., please visit **www.Coherent.com** for technical assistance, or phone your local Service Representative. Service Representative phone numbers and addresses can be found on the Coherent web site.

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Preface

This manual contains user information for the OBIS LG Optically Pumped Semiconductor Laser (OPSL).

Read this manual carefully before operating the laser for the first time. Special attention should be given to the material in Section One: Laser Safety, which describes the safety features built into the laser.

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

Use of the system in a manner other than that described herein may impair the protection provided by the system.

U.S. 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 should 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.

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.

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.

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 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.

SECTION ONE: LASER SAFETY

Optical Safety

Laser light, because of its special properties, poses safety hazards not associated with light from conventional sources. The safe use of lasers requires that all laser users, and everyone near the laser system, are aware of the dangers involved. The safe use of the laser depends upon the user being familiar with the instrument and the properties of coherent, intense beams of light.

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

Laser beams can ignite volatile substances such as alcohol, gasoline, ether and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers and photodiodes. Reflected beams may also cause damage. For these reasons, and others, the user is advised to follow the precautions below.

1. Observe all safety precautions in the operator's manual (this document).
2. Extreme caution should be exercised when using solvents in the area of the laser.
3. Limit access to the laser to qualified users who are familiar with laser safety practices and who are aware of the dangers involved.
4. Never look directly into the laser light source or at scattered laser light from any reflective surface. Never sight down the beam into the source.
5. Maintain experimental setups at low heights to prevent inadvertent beam-eye encounter at eye level.

WARNING!
Laser safety glasses can present a hazard as well as a benefit; while they protect the eye from potentially damaging exposure, they block light at the laser wavelengths, which prevents the operator from seeing the beam. Therefore, use extreme caution even when using safety glasses.

6. As a precaution against accidental exposure to the output beam or its reflection, individuals using the system should wear laser safety glasses as required by the wavelength being generated.
7. Use the laser in an enclosed room. Laser light remains collimated over long distances and therefore presents a potential hazard if not confined.
8. Post warning signs in the area of the laser beam to alert individuals present.
9. Advise all individuals using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access.

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.

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. The FDA accession number is 91R0252-215.

Laser Emission and Classification

The OBIS LG laser is classified by the United States National Center for Device and Radiological Health (CDRH) as a CLASS IIIB laser product. It emits INVISIBLE LASER RADIATION of 355 nm; collinear radiation at 532 and 1064 nm may also be present.

Laser Radiation Emission Indicator

A yellow indicator light is provided on the front of the laser subsystem. This light is illuminated when the laser pump diode is energized. This light may not meet the IEC 60825 requirement that warning laser lights must be fail safe or redundant. The OBIS LG OEM controller 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.

Interlock

Hazardous Radiation Exposure

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

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 (see Figure 1-1). The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.

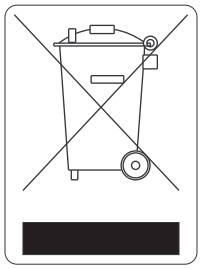


Figure 1-1. Waste Electrical and Electronic Equipment Label

CDRH and Regulatory Compliance

The OBIS LG is an OEM product designed for incorporation into other equipment. Accordingly, Coherent has provided CDRH with a supplemental report for compliance. The user is responsible for full CDRH compliance and/or other regulatory compliance in the loca-

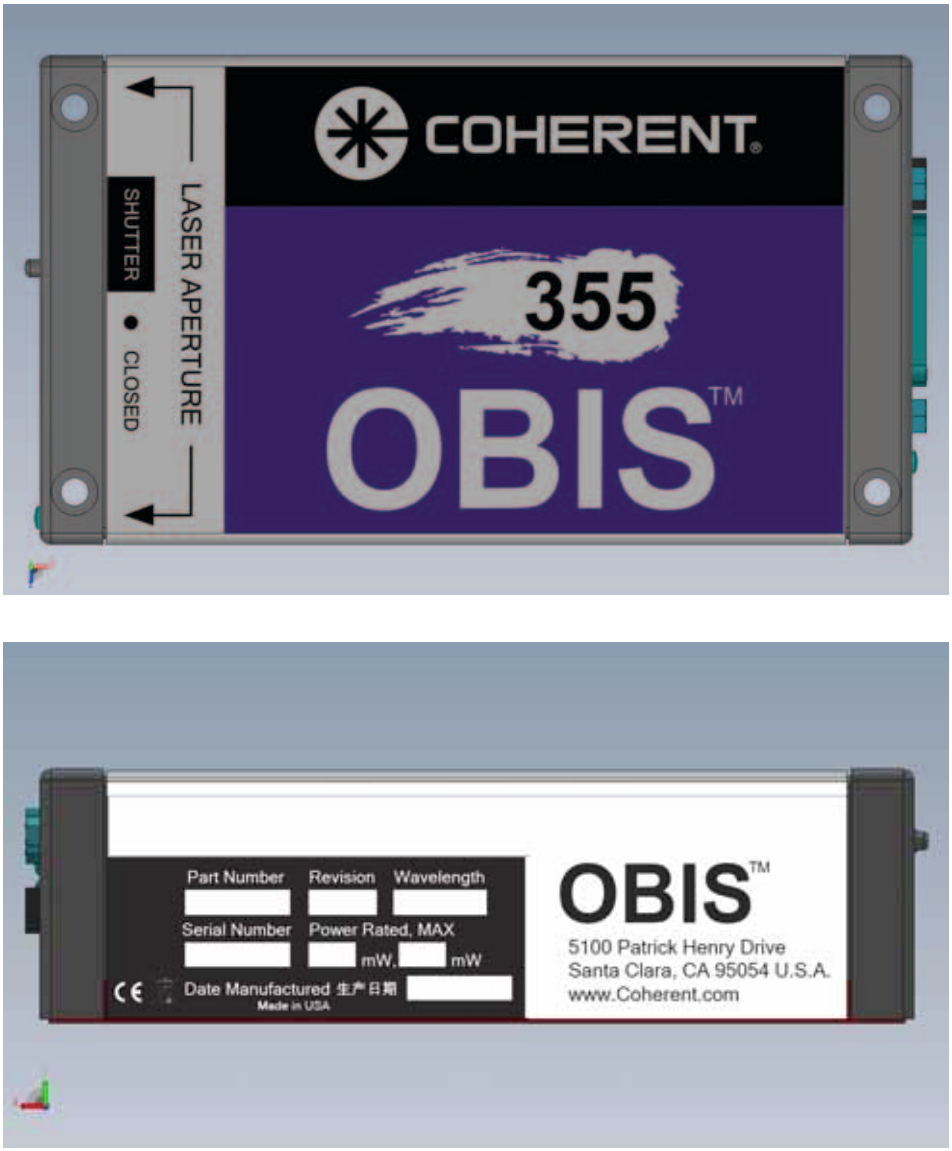


Figure 1-2. Laser Label Locations

Figure 1-2. Laser Label Locations

Table 1-1. Label Description - Head

	LABEL	DESCRIPTION
1	Part Number Revision Wavelength Serial Number Power Rated, MAX mW, mW Date Manufactured 生产日期 Made in USA OBIS™ 5100 Patrick Henry Drive Santa Clara, CA 95054 U.S.A. www.Coherent.com	Serial Number Identification
2	VISIBLE AND INVISIBLE LASER RADIATION. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION. CLASS 3b LASER PRODUCT PER EN60825-1(2007) 495mW MAX CW LASER AT 355 nm, <1mW AT 532 AND 1064 nm THIS PRODUCT IS INTENDED FOR USE SOLELY AS A COMPONENT OF AN O.E.M. PRODUCT AND DOES NOT COMPLY WITH CDRH PERFORMANCE STANDARDS, 21 CFR SUBCHAPTER J IF OPERATED AS A STAND ALONE INSTRUMENT.	Radiation warning class 3b
	VISIBLE AND INVISIBLE LASER RADIATION. AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION. CLASS 4 LASER PRODUCT PER EN60825-1(2007) 20 WATTS MAX CW LASER AT 532 nm OR 1064 nm THIS PRODUCT IS INTENDED FOR USE SOLELY AS A COMPONENT OF AN O.E.M. PRODUCT AND DOES NOT COMPLY WITH CDRH PERFORMANCE STANDARDS, 21 CFR SUBCHAPTER J IF OPERATED AS A STAND ALONE INSTRUMENT.	Radiation warning class 4

Sources of Additional Information

The following are sources for additional information on laser safety standards and safety equipment and training.

Laser Safety Standards

Safe Use of Lasers
Document Z136.1
American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
Tel: (212) 354-3300

ANSI Z136.1
Occupational Safety and Health Administration (OSHA)
U.S. Department of Labor
200 Constitution Avenue N.W.
Washington, DC 20210

A Guide for Control of Laser Hazards
American Conference of Governmental and Industrial Hygienists (ACGIH)
6500 Glenway Avenue, Bldg. D-7
Cincinnati, OH 45211
Tel: (513) 661-7881

Laser Safety Guide
Laser Institute of America
12424 Research Parkway, Suite 130
Orlando, FL 32826
Tel: (407) 380-1553

Equipment and Training

Laser Focus Buyer's Guide
Laser Focus World
One Technology Park Drive
P.O. Box 989
Westford, MA 01886-9938
Tel: (508) 692-0700

Photonics Spectra Buyer's Guide
Photonics Spectra
Berkshire Common
Pittsfield, MA 01202-4949
Tel: (413) 499-0514

Lasers and Optronics Buyer's Guide
Lasers and Optronics
301 Gibraltar Dr.
P.O. Box 650
Morris Plains, NJ 07950-0650
Tel: (210) 292-5100

SECTION TWO: DESCRIPTION AND SPECIFICATIONS

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. The OBIS LG is available in a variety of power levels and wavelengths in the visible and UV parts of the spectrum.

Table 2-1. OBIS LG

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

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 2-1). The emission wavelength is engineered by the composition and thickness of the gain medium.

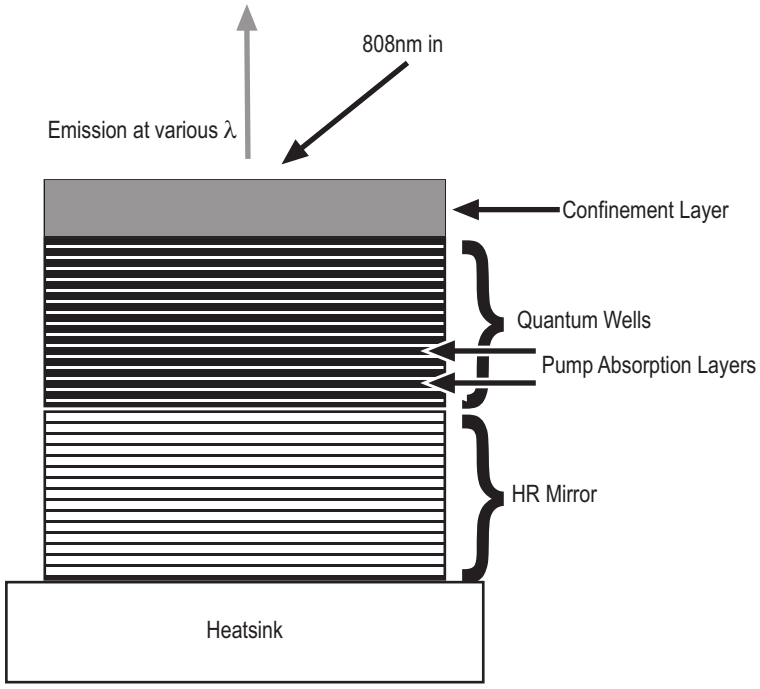


Figure 2-1. OPSL Diagram

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.

Specifications

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

Table 2-2. Utility Requirements, Dimensions and Weights

PARAMETER	VALUES
ELECTRICAL	
Input voltage (DC)	24 V ± 10%
Power Consumption	<150 W
CE Mark	EN61010-1, EN60825-1, EN61326-1, EN55011, EN50581
DIMENSIONS	
Laser Head with Integrated Controller (L x W x H)[a]	125 x 70 x 36 mm
WEIGHTS	
Laser Head with Integrated Controller	580 g (1 Lb 4.5oz)
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.

Dimensions

The dimensions of the OBIS LG laser subsystem is shown in Figure 2-2.

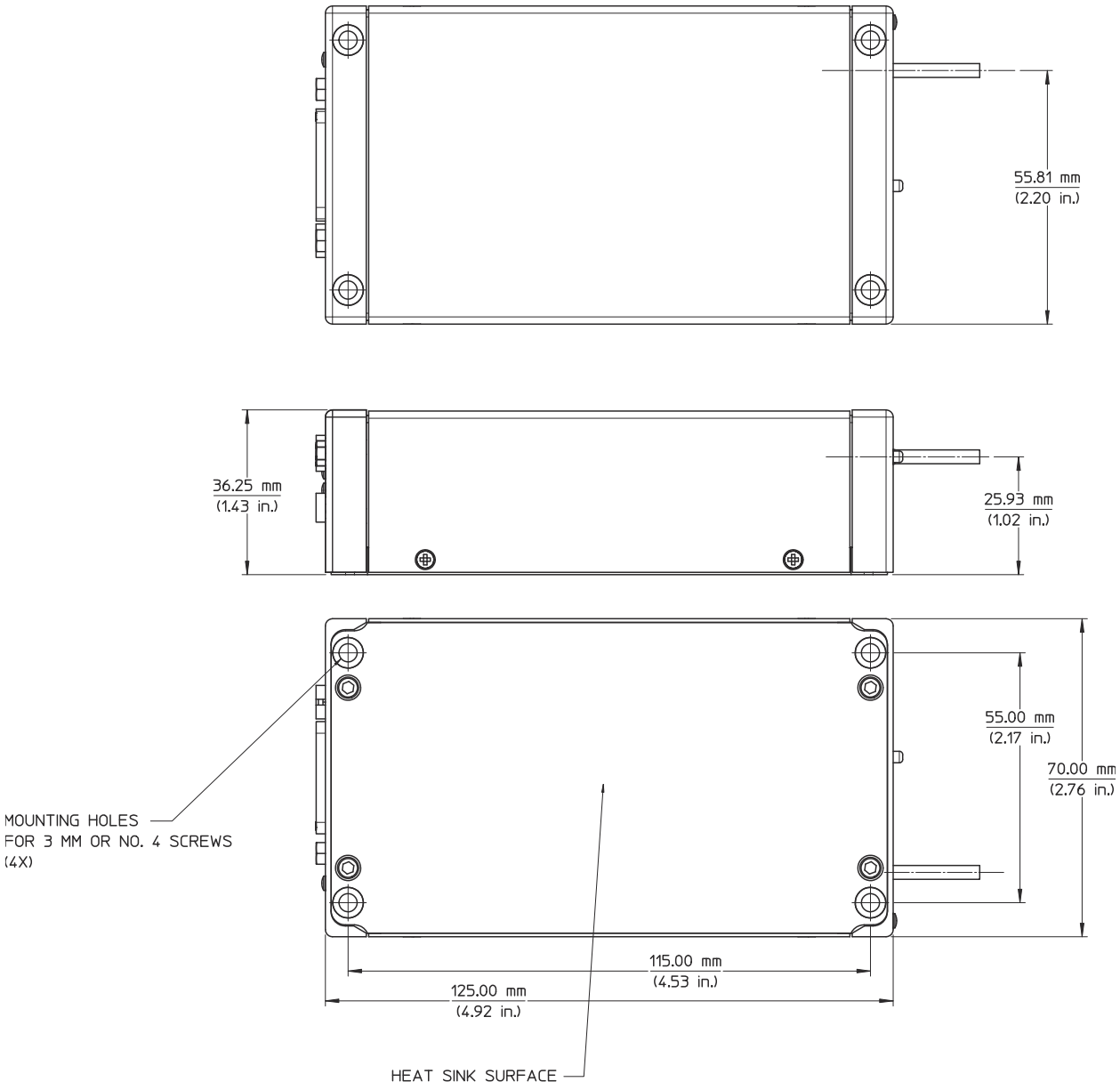


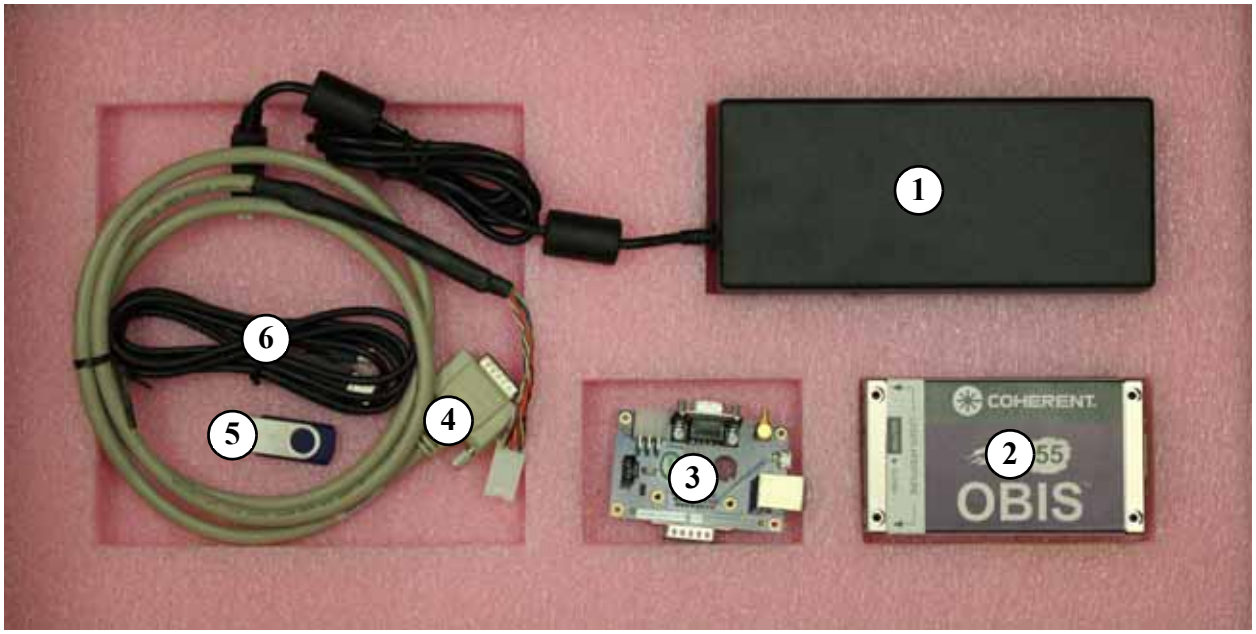
Figure 2-2. OBIS LG

SECTION THREE: INSTALLATION AND INTEGRATION

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 (800-438-6323) 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.



The components are shown without wrapper to show contents

1. Power Supply
2. Laser Head
3. Break Out Board
4. Cable Assembly, µΞ Obis Power to Laser, HD 26 Pin
5. Flash Drive
6. Mini B5 USB Cable

Table 3-1. OBIS LG in shipping box[a]

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

Heat Management Requirements (for use with non-Coherent heat sink)

To integrate OBIS LG laser system into a tool, some aspects and provisions need to be considered and supplied.

Mechanical interface

The laser head must be secured to the instrument. If a heat sink is supplied for the optical base plate and the optical design of the tool can accept small thermal effects, the laser can be attached from the top. Use the pattern of threaded holes (M3 or #6) on the baseplate (Figure 3-1).

If the removal of heat through the optical base plate is not an option, install the laser head upside down. Use the pattern of threaded holes (M3 or #6) on the baseplate (Figure 3-1).

The laser has threaded holes (M4-0.7) in its base to attach the heat sink to the laser (Figure 3-2). Refer to Figure 3-3 for dimensions.

Figure 3-1. Laser Secured from Top

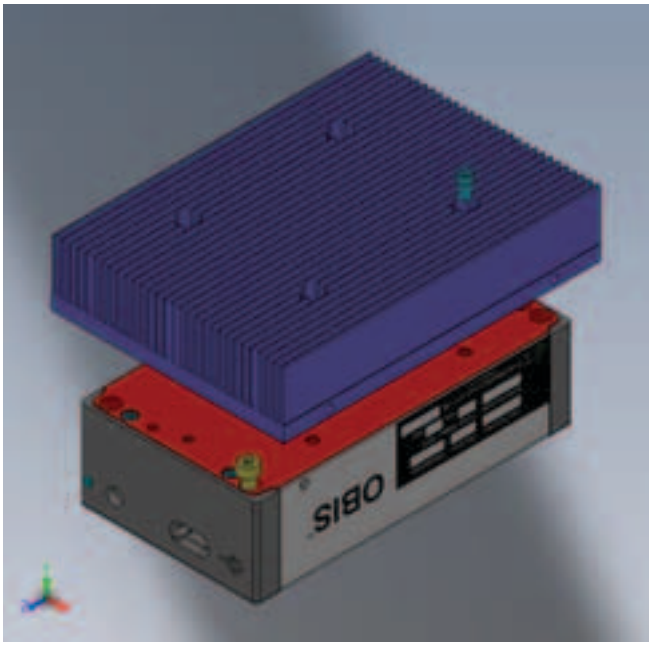


Figure 3-2. Laser Secured Upside Down

Thermal Interface

Make sure that the thermal interface of the heat sink and the laser head overlap completely. Refer to Figure 3-3 for the dimensions of the thermal interface and other features on the laser head.

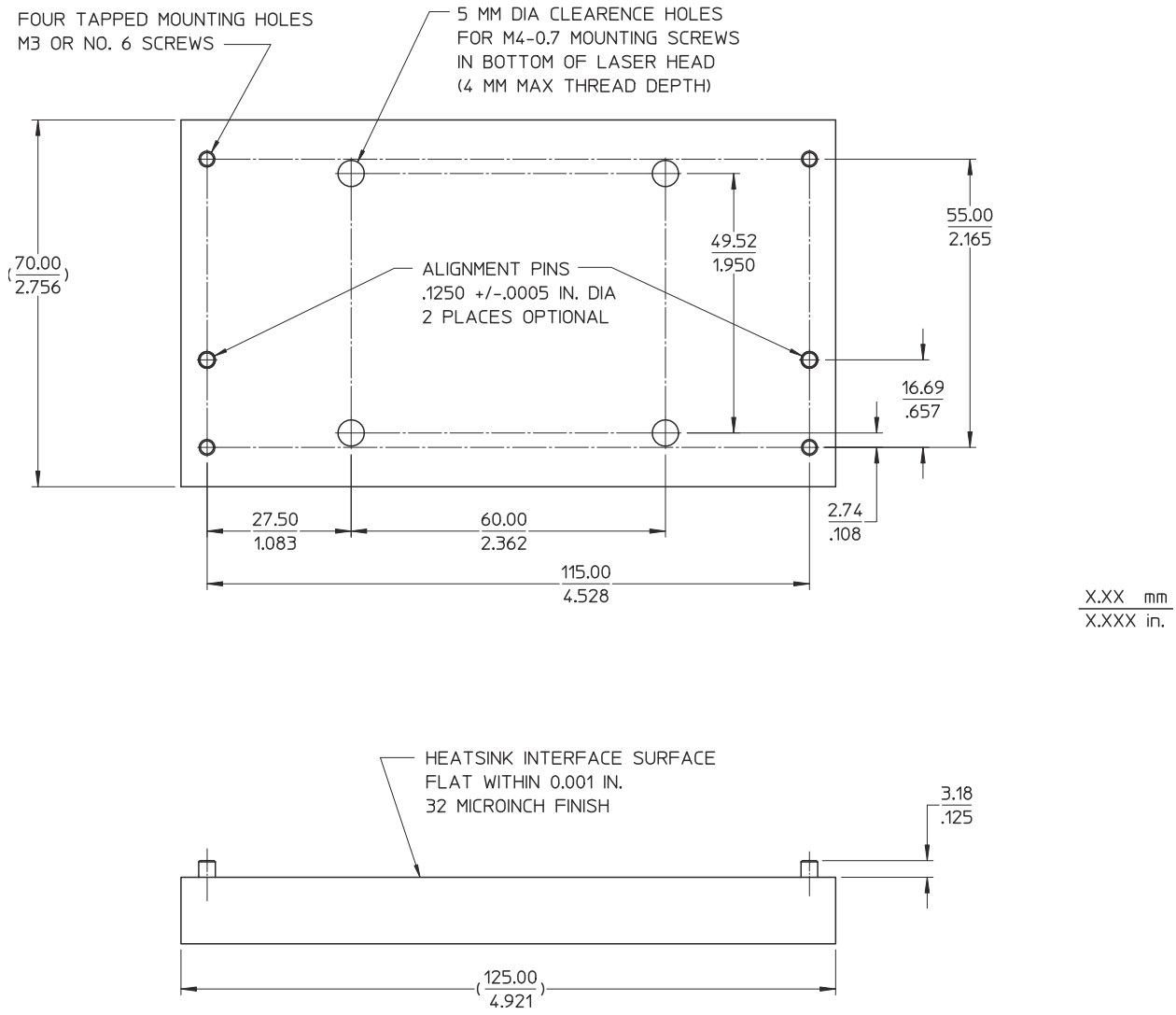


Figure 3-3. Thermal Interface

Heat Sink Design Guidelines

The OBIS LG laser system is available in two power levels. The heat sink requirements are different for the two power levels. For this discussion, the heat sink will be characterized by its thermal impedance[1].

Maximum ambient operating temperature is determined by the heat sink properties and the output power of the laser. See Figure 3-4 to find the correct the heat sink requirements. Figure 3-4 Gives the maximum operating temperature as a function of the heat sink thermal impedance for the two available OBIS LG power levels.

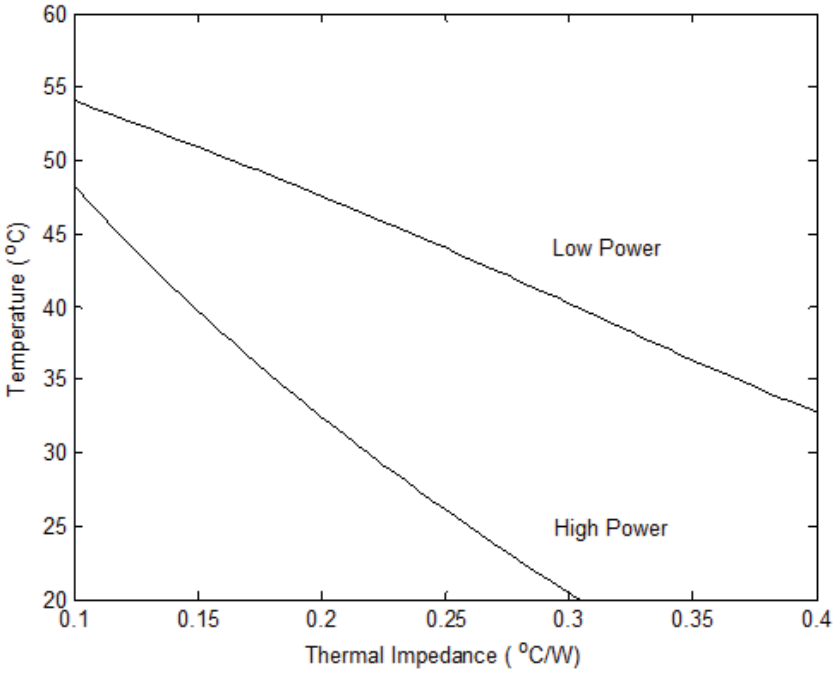


Figure 3-4. Heat Sink Requirements

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 heat sink 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 3-4) are shown in Figure 3-5. Figure 3-5shows the maximum amount of heat deposited on the heat sink when the laser is operated at the maximum temperature from Figure 3-4. The shape of the curve for the low-power version is caused by different limiting mechanisms: Thermal runaway for high thermal impedance heat sinks and baseplate temperature safety interlock limitation for low impedance.

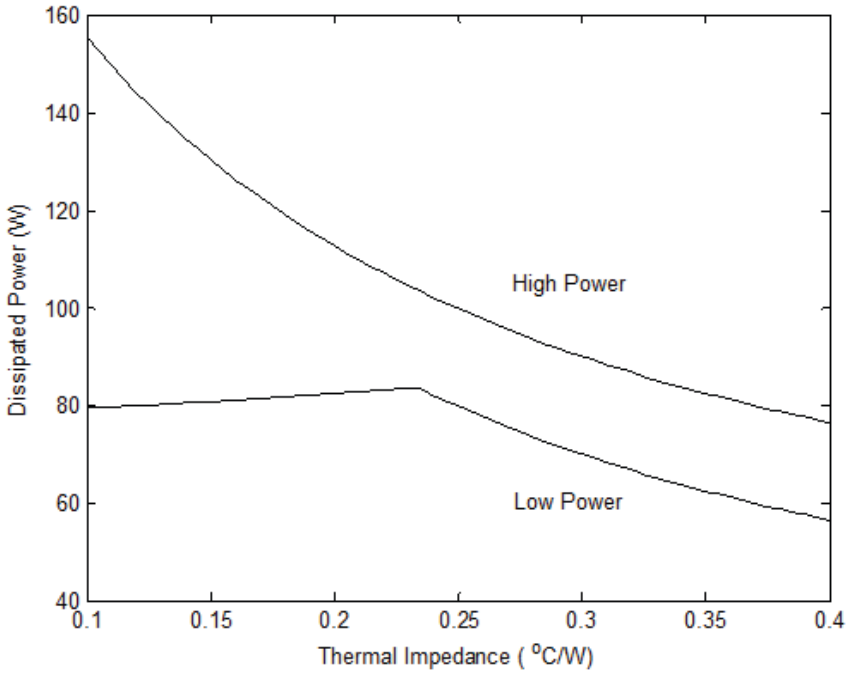


Figure 3-5. Power Dissipated in the Heat Sink

Power and control

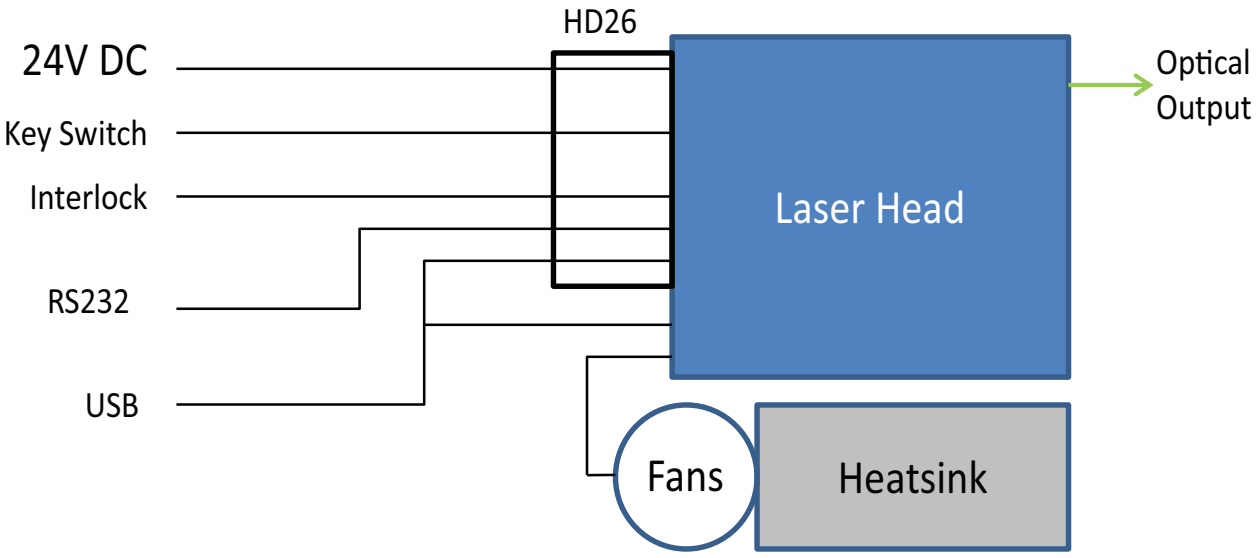


Figure 3-6. Connection Block Diagram

At minimum, the laser requires a source of 24V DC to release a beam at the necessary optical output power.

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 RS232. The pins are for initial configuration and for the continuous computer monitor function. For applications where the continuous monitor function is not necessary, a separate mini-B5 USB for initial configuration is supplied on the back of the unit.

Head Control Connector

Access connections for 24VDC, keyswitch, interlock, RS232 and USB through the HD26 connector in the back of the unit. The pin assignments are shown in Table 3-2 .

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. 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.

For applications that is required to monitor the laser status continuously, the HD26 connector has pins for USB and RS232 control. Other applications may require computer control for initial configuration only. in such cases, disable signals to pins 10 and 11 and use the Mini B5-USB connector at the back of the unit.

One USB connection can be used at a time.

Table 3-2. 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
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.

Computer Control

Software Installation:

1. Put the supplied flash drive into your PC.
2. Install the Coherent Connection to your PC.
3. Open "CoherentConnectionHelp" folder found in the flash drive. Follow instructions.

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.

Windows XP

1. Find the CohrHOPS.inf file on the flash drive. This file will be needed in step 5.
2. Connect the mini-B to standard-A USB cable between the OBIS LG and the computer. Connect OBIS LG to facility power.
3. When the Found New Hardware Wizard screen appears, select No**, not at this time**, and then click **Next** to continue.
4. Select **Install from a list or specific location (Advanced)**, and then click **Next** to continue.
5. Browse to the location of **CohrHOPS.inf**.
6. Click **Continue Anyway** to continue with the installation.
7. Click **Finish** to complete the installation.
8. Verify that the OBIS LG appears as **Coherent HOPS Device** in the **Device Manager**.

Windows 7

1. Find the **CohrHOPS.inf** file on the flash drive. This file will be needed in step 6.
2. Connect the mini-B to standard-A 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 3-7. Found New Hardware Wizard

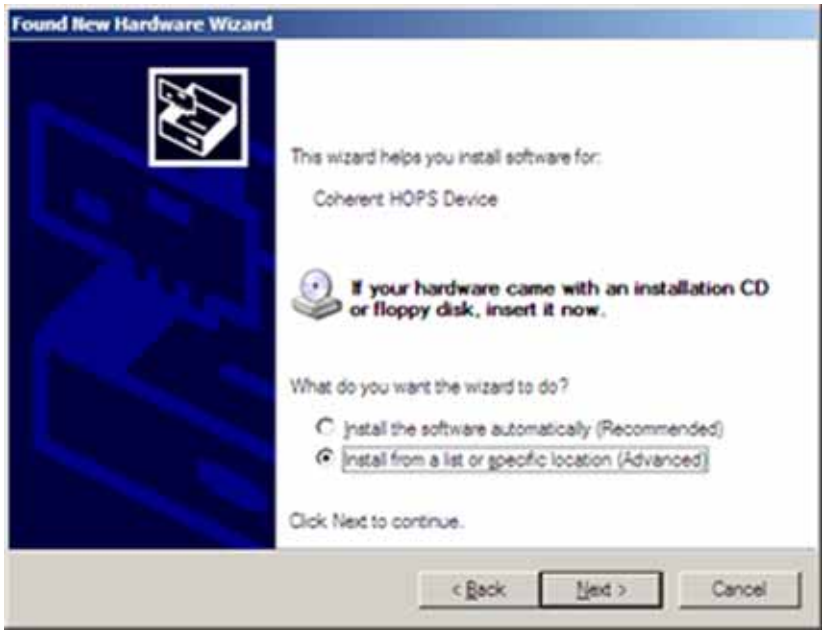


Figure 3-8. Install from a list...

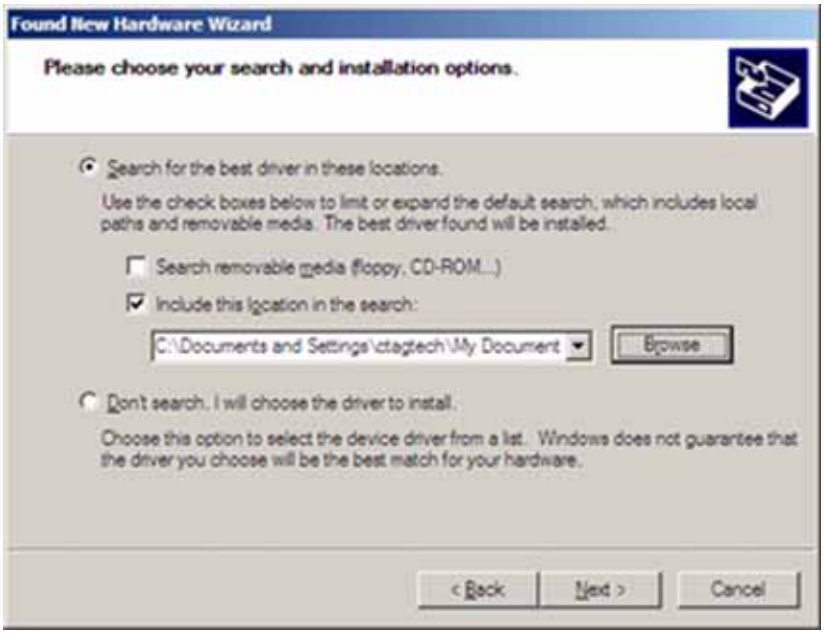


Figure 3-9. CohtHOPS.inf

Figure 3-10. Continue Anyway

Figure 3-11. Finish

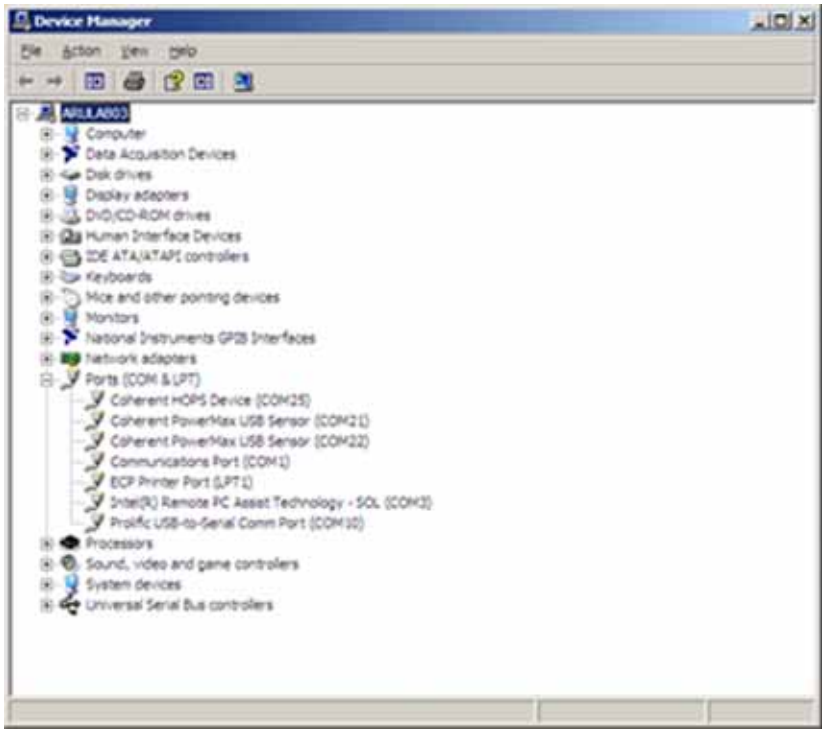


Figure 3-12. Device Manager

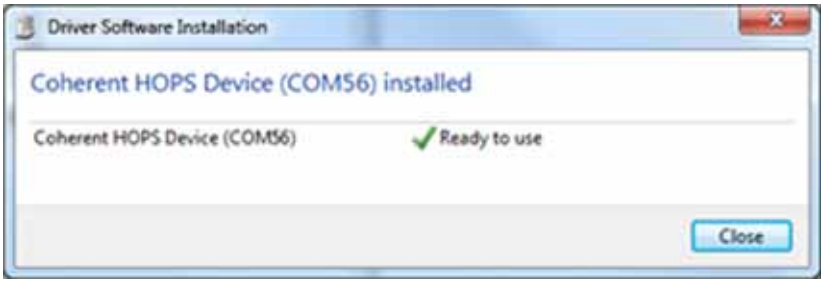


Figure 3-13. Ready to use

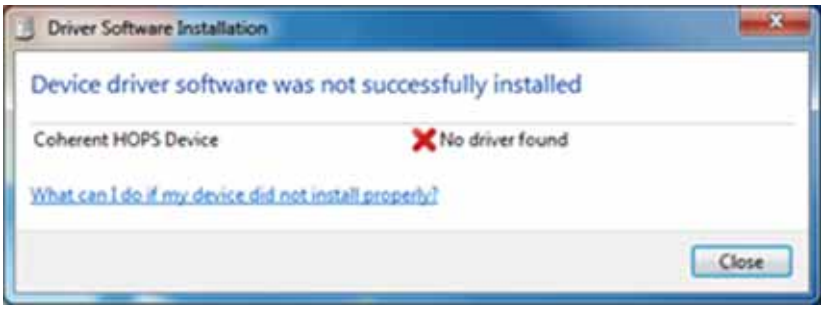


Figure 3-14. No driver found

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…**

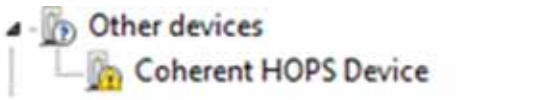


Figure 3-15. Update Driver Software

5. Select **Browse my computer for driver software**.

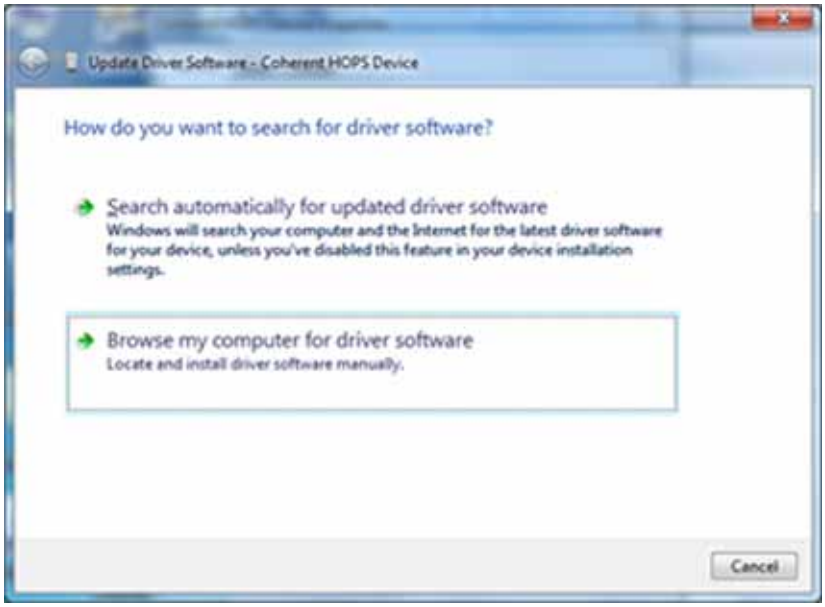


Figure 3-16. Browse my computer

6. Find the folder that has **CohrHOPS.inf**. Click **Next**.

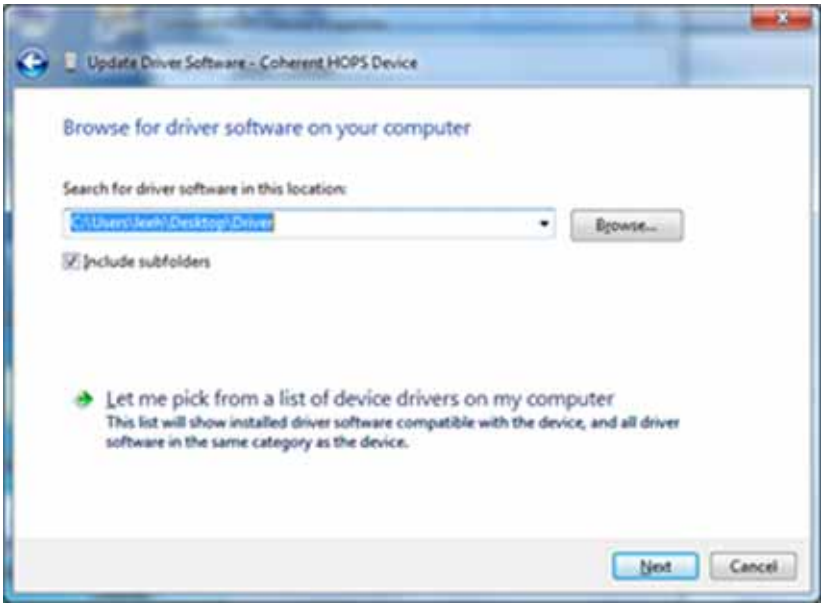


Figure 3-17. CohrHOPS.inf

7. Select **Install this driver software anyway**.

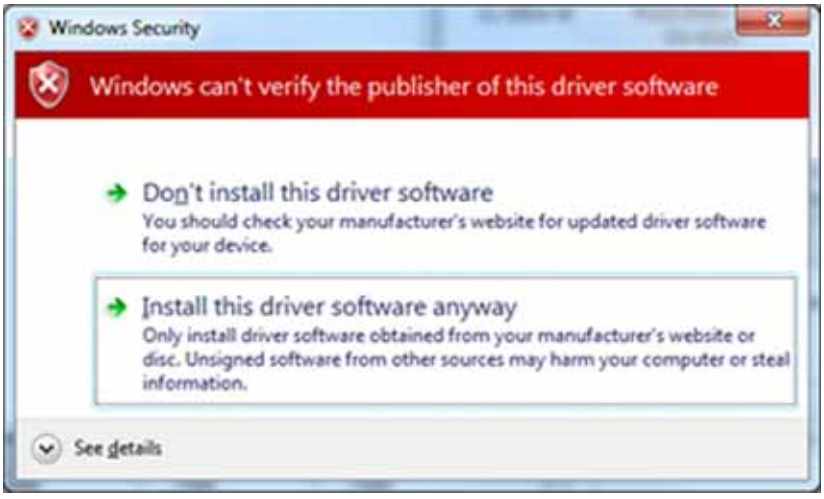


Figure 3-18. Install this driver software anyway

8. Windows will report successful driver installation.

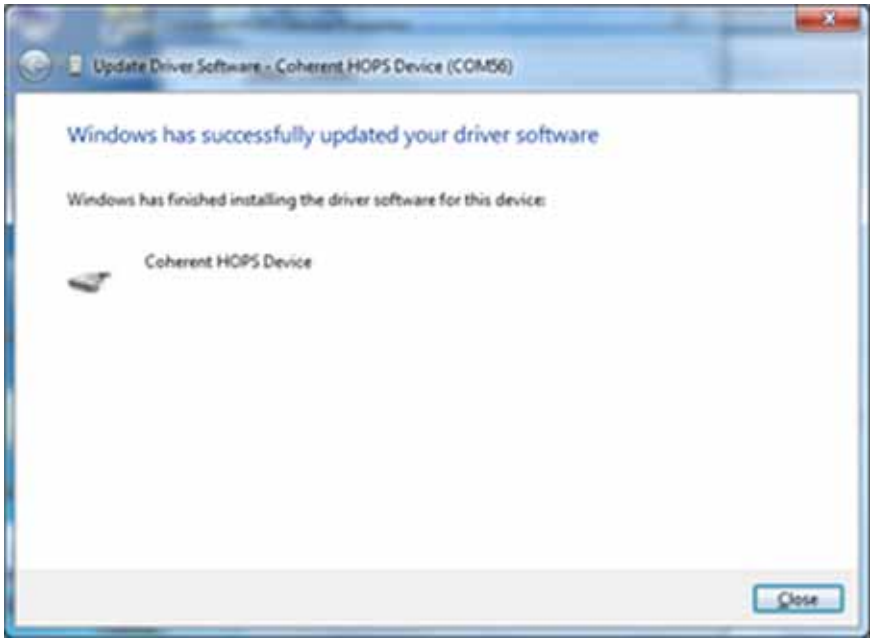


Figure 3-19. Successful Installation

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

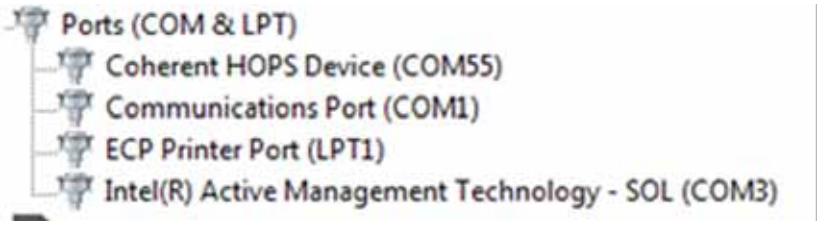
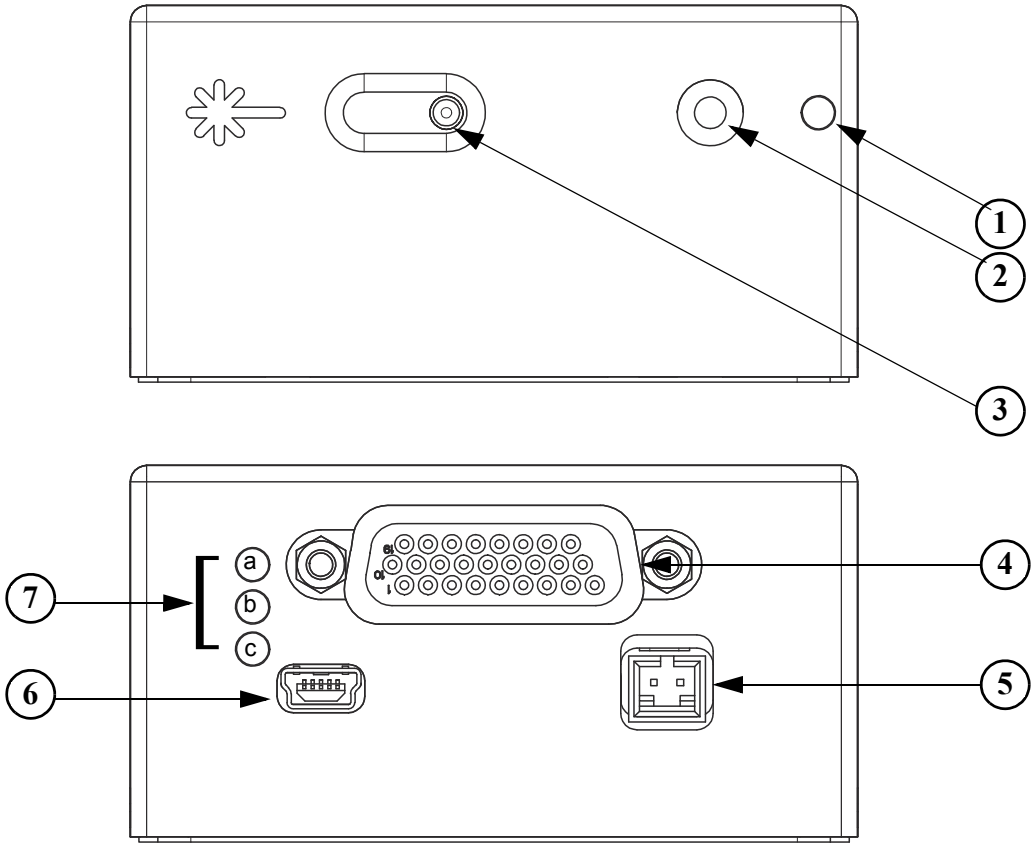


Figure 3-20. Device Manager

SECTION FOUR: CONTROLS, INDICATORS AND FEATURES

Laser Head



Front **Back**

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 Fail (red)

Figure 4-1. OBIS LG Indicators and Connections

SECTION FIVE: OPERATION

Operation:

Once installation is complete, the laser is ready for operation. The laser does not include any manual control (other than the safety shutter). Give all commands through the computer interface. This section will describe a selection of computer commands for: daily operation and configuration. Refer to "Section Seven: Host Interface" for a full description of the computer interface. The OBIS LG can also be controlled through the Coherent Connection software package. Refer to the documentation included with the program.

USB and RS-232 Remote Monitor

The communication protocol is the same for the USB and RS-232 connection. The RS-232 and USB connections in the HD26 connector can be used simultaneously. But the two USB connectors (min-B and the pins in the HD 26 connector) cannot be used simultaneously. Commands are executed in the order they are received, with priority for no connection. In addition to the OBIS command set, the OBIS LG is backwards-compatible with the HOPS command set.

Table 5-1. RS-232 Communication Settings

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

Table 5-2. 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)

SECTION SIX: 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.

Troubleshooting

The following table list symptoms, causes and solutions for trouble-shooting the OBIS LG laser system.

It either sinks or swims. TBD.

SECTION SEVEN: 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.

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 7-1. Host Command Quick Reference (Sheet 1 of 4)

Command	Compatibility Command	Description	Page No.
Mandatory Commands/Queries			
IEEE-488.2			
*IDN?		Gets laser identification string	7-8
*RST		Initiates warm boot	7-8
*TST?		Runs self-test, if implemented	7-8
Session Control			
SYSTem:COMMunicate:HANDshaking		Turns handshaking on or off	7-9
SYSTem:COMMunicate:HANDshaking?		Gets handshaking setting	7-9
SYSTem:COMMunicate:PROMpt		Turns communication prompt on or off	7-9
SYSTem:COMMunicate:PROMpt?		Gets prompt setting	7-9
SYSTem:AKEY		Turns automatic key on or off	7-20
SYSTem:AKEY?		Gets automatic key setting	7-20
SYSTem:AUTostart		Turns auto-start on or off	7-9
SYSTem:AUTostart?		Gets auto-start setting	7-9

Table 7-1. Host Command Quick Reference (Sheet 2 of 4)

Command	Compatibility Command	Description	Page No.
SYSTem:STATus?		Gets system status	7-10
SYSTem:FAULt?		Gets system faults	7-11
SYSTem:INDicator:LASer		Turns the laser head LEDs on or off.	7-14
SYSTem:INDicator:LASer?		Gets the laser head LEDs setting.	7-14
SYSTem:ERRor:COUNt?		Gets the number of error records in the error queue	7-14
SYSTem:ERRor:NEXT?		Gets the next error record in the error queue	7-14
SYSTem:ERRor:CLEar		Clears all error records in the error queue	7-15
OBIS LG Common Commands/Queries			
System Information			
SYSTem:INFormation:MODel?		Gets the model name	7-15
SYSTem:INFormation:MDATe?		Gets the manufacture date	7-15
SYSTem:INFormation:CDATe?		Gets the calibration date	7-15
SYSTem:INFormation:SNUMber?	?HID	Gets the laser serial number	7-15
SYSTem:INFormation:PNUMber?		Gets the laser part number	7-16
SYSTem:INFormation:FVERsion?		Gets the firmware version	7-16
SYSTem:INFormation:PVERsion?		Gets the OBIS protocol version	7-16
SYSTem:INFormation:WAVelength?	?WAVELENGTH	Gets the nominal wavelength	7-16
SYSTem:INFormation:POWer?		Gets the power rating	7-17
SYSTem:INFormation:TYPe?	?HTYPE	Gets the device type	7-17
SOURce:POWer:NOMinal?		Gets the nominal output power	7-17
SOURce:POWer:LIMit:LOW?		Gets the minimum output power	7-17
SOURce:POWer:LIMit:HIGH?	?PLIM	Gets the maximum output power	7-17
SYSTem:INFormation:USER		Sets user-defined information in memory	7-17
SYSTem:INFormation:USER?		Gets user-defined information	7-17
System State			
SYSTem:CYCLes?		Gets number of electronics on/off power cycles	7-18
SYSTem:HOURs?	?EEH	Gets total hours that electronics has been powered on	7-18
SYSTem:DIODe:HOURs?	?HH	Gets total hours that laser diode has operated	7-18
SOURce:POWer:LEVel?	?P	Gets measured output power from internal power sensor	7-18

Table 7-1. Host Command Quick Reference (Sheet 3 of 4)

Command	Compatibility Command	Description	Page No.
SOURce:CURRent:LEVel?	?C	Gets measured current.	7-18
SOURce:TEMPerature:BASeplate?	?TBASE	Gets base plate temperature	7-18
Operational			
SOURce:AM:INTernal	CMODECMD=	Sets the operating mode to internal constant power or constant current.	7-19
SOURce:AM:EXTernal		Sets the operating mode to external modulation	7-19
SOURce:AM:SOURce?		Gets the operating mode	7-19
SOURce:POWer:LEVel:IMMediate:AMPLitude	PCMD=	Sets the power setpoint. This command is volatile in OBIS LG.	7-19
SOURce:POWer:LEVel:MEMory:AMPLitude	PMEM=	Sets the start-up power setpoint.	7-19
SOURce:POWer:LEVel:MEMory:AMPLitude?	?PMEM	Gets the start-up power level.	7-19
SOURce:AM:STATe	KSWCMD=	Turns the laser ON or OFF. This command is not nonvolatile in OBIS LG.	7-20
SOURce:AM:STATe?	?KSWCMD	Gets the laser on/off state	7-20
SYSTem:CDRH		Enables or disables the CDRH laser emission delay	7-20
SYSTem:CDRH?		Gets CDRH laser emission delay setting	7-20
HOPS-Specific Commands/Queries			
SOURce:TEMPerature:BRF?	?TBRF	Gets the BRF measured temperature	7-25
SOURce:TEMPerature:SHG?	?TSHG	Gets the SHG measured temperature	7-25
SOURce:TEMPerature:THG?	?TTHG	Gets the THG measured temperature (UV models only)	7-26
SOURce:TEMPerature:ETALon?	?TETA	Gets the etalon measured temperature (single frequency models)	7-21
SOURce:TEMPerature:RESonator?	?TRES	Gets the resonator measured temperature	7-21
SOURce:TEMPerature:BRF:SERVo:SETPoint?	?TBRFCMD	Gets the BRF setpoint temperature	7-22
SOURce:TEMPerature:SHG:SERVo:SETPoint?	?TSHGCMD	Gets the SHG setpoint temperature	7-26
SOURce:TEMPerature:THG:SERVo:SETPoint?	?TTHGCMD	Gets the THG setpoint temperature (UV models)	7-26
SOURce:TEMPerature:ETALon:SERVo:SETPoint?	?TETACMD	Gets the etalon setpoint temperature (single frequency models)	7-26
SOURce:TEMPerature:RESonator:SERVo:SETPoint?	?TRESCMD	Gets the resonator setpoint temperature	7-26
SOURce:TEMPerature:BRF:DRIVer:OUTPut?	?BRFD	Gets the BRF heater output	7-27

Table 7-1. Host Command Quick Reference (Sheet 4 of 4)

Command	Compatibility Command	Description	Page No.
SOURce:TEMPerature:SHG:DRIVer:OUTPut?	?SHGD	Gets the SHG heater output	7-27
SOURce:TEMPerature:THG:DRIVer:OUTPut?	?THGD	Gets the THG heater output	7-27
SOURce:TEMPerature:ETALon:DRIVer:OUTPut?	?ETAD	Gets the etalon heater output	7-27
SOURce:TEMPerature:RESonator:DRIVer:OUTPut?	?RESD	Gets the resonator TEC driver output	7-27
HOPS Compatibility Commands/ Queries			
SOURCE:CURRent:PROTection:LEVel?	?CLIM	Gets the current limit	7-27
	?CMODECMD	Gets whether the system is commanded to current mode or power mode	7-27
	?CMODE	Gets whether the system is in current mode or power mode	7-24
	?FF	Gets the fault code (compatibility format)	7-28
	?INT	Gets the interlock state	7-28
	?KSW	Gets the composite key state	7-27
	?REM	Get the remote or local mode state	7-28
	REM=	Set remote or local mode	7-28

Message Considerations

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 the “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

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.

Message Terminators

Messages between the OBIS LG Laser and the host computer or controller are comprised entirely of ASCII string characters; no binary messages are supported. All message strings passing through the host interface are terminated to signal the end of a message string. The maximum message length supported is 255 bytes, which includes all terminating characters.

Messages 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.

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.

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 the case of error overflow, the last error in the error queue is an indication of error overflow.

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.

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.

Commands and Queries

Table 7-2. 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	

Table 7-2. Supported Commands by Laser Type

OBIS LS Extension Command Set	
OBIS LG Extension Command Set	X
HOPS Compatibility Command Set	X

Mandatory Commands and Queries

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.

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>". The fourth field is the firmware date in the YYYYMMDD format.

Query: *IDN?

Response: Coherent, Inc - OBIS LG 355nm 15mW - UX-0.0.0 - 20130101

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

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>

OBIS Mandatory Commands/Queries

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

Session Control Commands

Handshaking

Enables/disables handshaking

Nonvolatile: Yes

Factory default: ON

Command: SYSTem:COMMunicate:HANDshaking ON|OFF

Query: SYSTem:COMMunicate:HANDshaking?

Response: ON|OFF

Command Prompt

Enables/disables command prompt

Nonvolatile: Yes

Factory default: OFF

Command: SYSTem:COMMunicate:PROMpt ON|OFF

Query: SYSTem:COMMunicate:PROMpt?

Response: ON|OFF

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 in the OBIS Remote. If the OBIS LG is connected to an OBIS Remote through an SDR cable, this setting is overridden by the hardware switch of the mini-controller; 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

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 7-3. 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
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.

Table 7-3. Status Code Bit Definitions (Continued)

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	Exsternal 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.

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 7-4. Fault Code Bit Definitions (Sheet 1 of 4)

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.

Table 7-4. Fault Code Bit Definitions (Sheet 2 of 4)

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 overcurrent	Hardware	Not applicable because OBIS LG implements a current limit.
6	00000040	Memory checksum error	Hardware	Nonvolatile memory checksum error
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

Table 7-4. Fault Code Bit Definitions (Sheet 3 of 4)

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
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

Table 7-4. Fault Code Bit Definitions (Sheet 4 of 4)

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.

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

Error Count Query

Returns the number of error records in the error queue.

Query: SYSTem:ERRor:COUNt?

Response: <integer count of error records stored>

Error Query

Gets the next error record(s) in the error queue. More than one error record may be queried using 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>

Clear All Errors

Clears all error records in the error queue.

Command: SYSTem:ERRor:CLEar

OBIS Common Commands and Queries

OBIS Common Commands and Queries is implemented by all OBIS devices that support the features contained in this section. If a device does not support a given feature, the command may be ignored.

System Information Queries

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

System Model Name Query

Returns the model name.

Query: SYSTem:INFormation:MODel?

Response: <model name>

System Manufacture Date Query

Returns the manufacture date.

Query: SYSTem:INFormation:MDATe?

Response: <manufacture date in YYYYMMDD format>

System Calibration Date Query

Returns the calibration date.

Query: SYSTem:INFormation:CDATe?

Response: <calibration date in YYYYMMDD format>

System Serial Number Query

Returns the serial number.

Query: SYSTem:INFormation:SNUMber?

Response: <serial number>

System Part Number Query

Returns the part number.

Query: SYSTem:INFormation:PNUMber?

Response: <manufacturer part number>

System Firmware Version Query

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

Query: SYSTem:INFormation:FVERsion?

Response: <firmware version>

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>

System Wavelength Query

Returns the nominal wavelength in nanometers.

Query: SYSTem:INFormation:WAVelength?

Response: <wavelength>

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>

Device Type Query

Returns the device type.

Query: SYSTem:INFormation:TYPe?

Response: LG

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>

CW Minimum Power Query

Returns the minimum laser output power in watts.

Query: SOURce:POWer:LIMit:LOW?

Response: <x.xxxxxx>

CW Maximum Power Query

Returns the maximum laser output power in watts.

Query: SOURce:POWer:LIMit:HIGH?

Response: <x.xxxxxx>

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>

System State Commands/Queries

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

System Power Cycle Query

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

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

System Power Hour Query

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

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

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>

System Output Power Level Query

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

Query: SOURce:POWer:LEVel?

Response: <x.xxxxxx>

System Output Current Query

Returns the laser current in amps

Query: SOURce:POWer:CURRent?

Response: <x.xxx>

Base Plate Temperature Query

Returns the base plate temperature in °C

Query: SOURce:TEMPerature:BASeplate?

Response: <x.xxx>

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.

Laser Operating Mode Selection

The OBIS LG supports three mutually exclusive operating modes.

- CWP (continuous wave, constant power)
- CWC (continuous wave, constant current)
- DIGSO (external digital modulation with power feedback)

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

Select Modulation Mode

Selects external digital modulation between off and the power setpoint

Nonvolatile: Yes

Default: Not selected

Command: SOURce:AM:EXTernal DIGSO

Laser Operating Mode Query

Gets the operating mode.

Query: SOURce:AM:SOURce?

Response: CWP|CWC|DIGSO

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>

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>

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

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

OBIS LG Commands

The commands in this section apply to OBIS LG

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

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>

BRF Temperature Query

Returns the BRF measured temperature in °C.

Query: SOURce:TEMPerature:BRF?

Response: <x.xxx>

SHG Temperature Query

Returns the SHG measured temperature in °C.

Query: SOURce:TEMPerature:SHG?

Response: <x.xxx>

THG Temperature Query

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

Query: SOURce:TEMPerature:THG?

Response: <x.xxx>

Etalon Temperature Query

Returns the etalon measured temperature in °C. Single frequency models only.

Query: SOURce:TEMPerature:ETALon?

Response: <x.xxx>

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>

BRF Setpoint Temperature Query

Returns the BRF setpoint temperature in °C.

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

Response: <x.xxx>

SHG Setpoint Temperature Query

Returns the SHG setpoint temperature in °C.

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

Response: <x.xxx>

THG Setpoint Temperature Query

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

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

Response: <x.xxx>

Etalon Setpoint Temperature Query

Returns the etalon setpoint temperature in °C. Single frequency models only.

Query: SOURce:TEMPerature:ETALon:SERVo:SETPoint?

Response: <x.xxx>

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>

BRF Heater Output Query

Returns the BRF heater output in nominal volts.

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

Response: <x.xxx>

SHG Heater Output Query

Returns the SHG heater output in nominal volts.

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

Response: <x.xxx>

THG Heater Output Query

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

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

Response: <x.xxx>

Etalon Heater Output Query

Returns the etalon heater output in nominal volts. Single frequency models only.

Query: SOURce:TEMPerature:ETALon:DRIVer:OUTPut?

Response: <x.xxx>

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.

System Serial Number Query

Returns the serial number.

Query: ?HID

Response: <serial number>

CW Maximum Power Query

Returns the maximum laser output power in watts.

Query: ?PLIM

Response: <x.xxxxxx>

System Power Hour Query

Returns the accumulated powered-on hours

Query: ?EEH

Response: <x.xxxx>

Diode Hour Query

Returns the accumulated laser emission hours

Query: ?HH

Response: <x.xxxx>

System Output Power Level Query

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

Query: ?P

Response: <x.xxxxxx>

System Output Current Query

Returns the laser current in amps

Query: ?C

Response: <x.xxx>

Base Plate Temperature Query

Returns the base plate temperature in °C

Query: ?TBASE

Response: <x.xxx>

Laser Operating Mode Query

Returns the operating mode of the laser. 0=power mode, 1=current mode, -1=all other modes

Query: ?CMODECMD

Response: 0|1

Current Mode Command Query

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

Query: ?CMODECMD

Response: 0|1

Current Mode Query

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

Query: ?CMODE

Response: 0|1

Set/Query Laser Power Level

Sets laser power setpoint in watts.

Nonvolatile: No.

Command: PCMD=<value>

Query: ?PCMD

Response: <x.xxxxxx>

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>

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

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>

BRF Temperature Query

Returns the BRF measured temperature in °C.

Query: ?TBRF

Response: <x.xxx>

SHG Temperature Query

Returns the SHG measured temperature in °C.

Query: ?TSHG

Response: <x.xxx>

THG Temperature Query

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

Query: ?TTHG

Response: <x.xxx>

Etalon Temperature Query

Returns the etalon measured temperature in °C. Single frequency models only.

Query: ?TETA

Response: <x.xxx>

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>

BRF Setpoint Temperature Query

Returns the BRF setpoint temperature in °C.

Query: ?TBRFCMD

Response: <x.xxx>

SHG Setpoint Temperature Query

Returns the SHG setpoint temperature in °C.

Query: ?TSHGCMD

Response: <x.xxx>

THG Setpoint Temperature Query

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

Query: ?TTHGCMD

Response: <x.xxx>

Etalon Setpoint Temperature Query

Returns the etalon setpoint temperature in °C. Single frequency models only.

Query: ?TETACMD

Response: <x.xxx>

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>

BRF Heater Output Query

Returns the BRF heater output in nominal volts.

Query: ?BRFD

Response: <x.xxx>

SHG Heater Output Query

Returns the SHG heater output in nominal volts.

Query: ?SHGD

Response: <x.xxx>

THG Heater Output Query

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

Query: ?THGD

Response: <x.xxx>

Etalon Heater Output Query

Returns the etalon heater output in nominal volts. Single frequency models only.

Query: ?ETAD

Response: <x.xxx>

Current Limit Query

Gets the current command limit

Query: ?CLIM

Response: <x.xxx>

Composite Keyswitch State Query

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

Query: ?KSW

Response: 0|1

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

Remote Mode Set/Query

Sets remote mode-do we need?

Compatibility command: REM=0|1

Query: ?REM

Response: 0|1

Compatibility Fault Query

Returns 16-bit fault code defined in Table 7-5.

Query: ?FF

Response: <16-bit fault code>

Table 7-5. ?FF Fault Codes

Code Bit	Error Value	Error Description
3	0008	Resonator temperature out-of-range
4	0010	BRF, SHG, THG or etalon 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.

Controls 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.

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.

PARTS LIST AND ACCESSORIES

Table A-1. Parts List

DESCRIPTION	PART NUMBER
Power Supply, Desktop, Switching, 220W, Universal AC Input, 24VDC/9A Output	1227314
Cable Assembly, uX Obis Power to Laser, HD26 Pin	1260035
OBIS LG Breakout Board	1256412

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

Table 1-1. Accessories List for UV

DESCRIPTION	NAME	PART NUMBER
FOR UV MODELS		
Low power thermopile sensor with 50µW resolution (19mm aperture) (RoHS)	PM3	1098336
Low power thermopile sensor with 50µW resolution with quartz filter (10mm aperture) (RoHS)	PM3Q	1098419
Low power thermopile sensor with 10µW resolution (10mm aperture) (RoHS)	PS10	1098350
Low power thermopile sensor with 10 µW resolution with quartz filter (10 mm aperture) (RoHS)	PS10Q	1098400
Low power thermopile sensor with 10 µW resolution with quartz filter (19 mm aperture) (RoHS)	PS19	1098413
Low power thermopile sensor with 10 µW resolution with quartz filter (19 mm aperture) (RoHS)	PS19Q	1098341
FOR VISIBLE MODELS		
10W max thermopile with broadband coating (RoHS)	PM10	1097901

PACKING PROCEDURES

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.

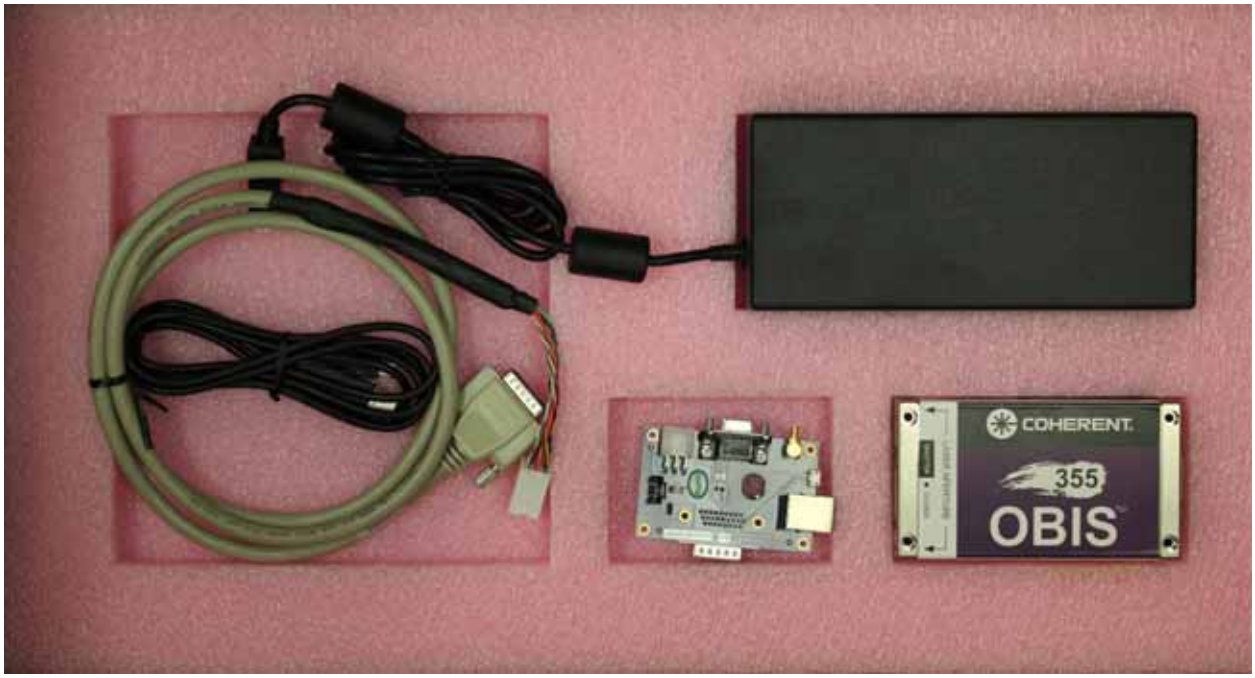
1. Key off and power off the laser and unplug the 24V power to the system.

Use static control precautions before disconnecting diode cable.

2. Disconnect all cables. Close shutter.
3. Coil the cables. Note 5 inch minimum bend radius.
4. Place all the cables in bag, secure with tape, and place bag in the small cardboard box in the shipping kit.
5. Remove laser head from heatsink.
6. Wrap the laser head in the PE bag provided and secure with tape.

The following figure is shown without the PE cover to illustrate the orientation of the items to be placed in the box. <u>For actual shipment, place the head inside a polyethylene (PE) bag prior to placing in the box.</u>

7. Place the laser head and controller in the shipping box in the proper orientation shown in Figure B-1.
8. Confirm the orientation of the upper packing foam is correct and place on top of the laser head and the controller.
9. Take the box of cables from step 3 and place on top of the top packing foam of the controller.
10. Include necessary paperwork for return shipment.
11. Close and seal box with tape. Apply appropriate shipping label and ship back to Coherent using company approved freight vendor.



Note: Shown without the PE wrap to illustrate the proper compartment for each assembly. The head and controller must be wrapped in PE bags.

Figure B-1. Orientation of Head and controller in Shipping Box

WARRANTY

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.

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.

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.

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

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