COHERENT

Operator's Manual
Genesis™ MX Series Laser

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Genesis™ MX Series Laser Operator's Manual

COHERENT
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Preface

This manual contains user information for the Genesis ™ MX Series 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.

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

NOTICE!
This user information is in compliance with section 1040.10 of the CDRH Performance Standards for Laser Products from the Health and Safety Act of 1968.

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 Genesis™ MX series laser system. Safety instructions presented throughout this manual must be followed carefully.

Hazards

Hazards associated with lasers generally fall into the following categories:

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

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

Optical Safety

Laser light, because of its special qualities, poses safety hazards not associated with light from conventional 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 listed in 'Performance Standards for Laser Products,' *United States Code of Federal Regulations*, 21CFR1040 10(d).

DANGER!
Direct eye contact with the output beam from the laser will cause serious damage 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 paint 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 and all personnel in proximity are advised to follow the precautions below.

Recommended Precautions and Guidelines

1. Observe all safety precautions in the preinstallation and operator's manuals.
2. All personnel should wear laser safety glasses rated to protect against the specific wavelengths being generated. Protective eye wear vendors are listed in the *Laser Focus World, Lasers and Optronics,* and *Photonics Spectra* Buyer's guides. Consult the ANSI, ACGIH, or OSHA standards listed at the end of this section for guidance.
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 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 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. 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.

WARNING!
Laser safety glasses protect the user from eye damage by blocking light at the laser wavelengths. However, this also prevents the operator from seeing the beam. Exercise extreme caution even while wearing safety glasses.

Electrical Safety

The Genesis™ MX series 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 Emission and Classification

The Genesis™ MX series laser is classified by the United States National Center for Device and Radiological Health (CDRH) as a CLASS 4 laser product. It emits VISIBLE AND INVISIBLE LASER RADIATION between 450 to 1154 nm.

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-825 requirement that warning laser lights must be fail safe or redundant. The Genesis™ MX has been designed to accommodate a warning light that is fail safe or redundant and meets the IEC-60825 requirements. Refer to the description of the interlock circuit in Section Three for further details.

Interlock

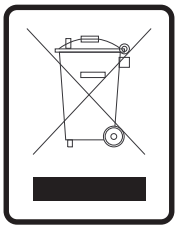
A normally closed remote interlock switch can be installed on the Genesis™ MX power supply. Refer to the description of the interlock circuit in Section Three for further details.

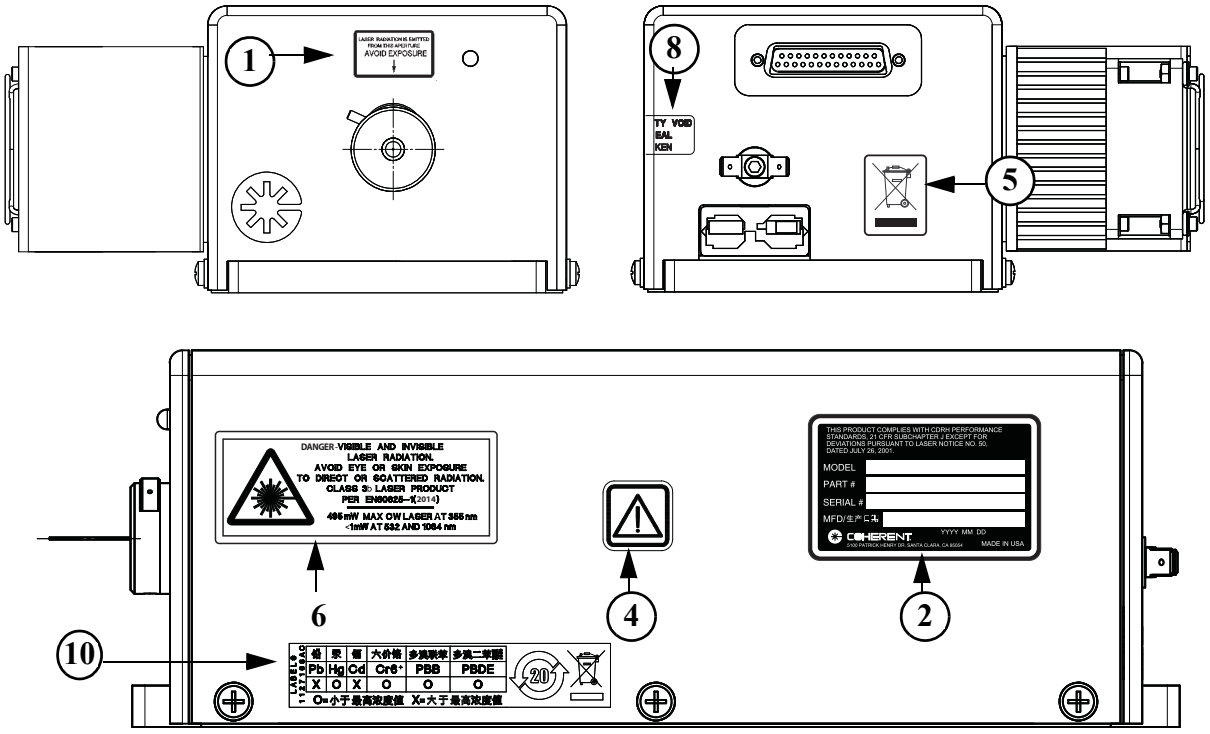
Hazardous Radiation Exposure

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

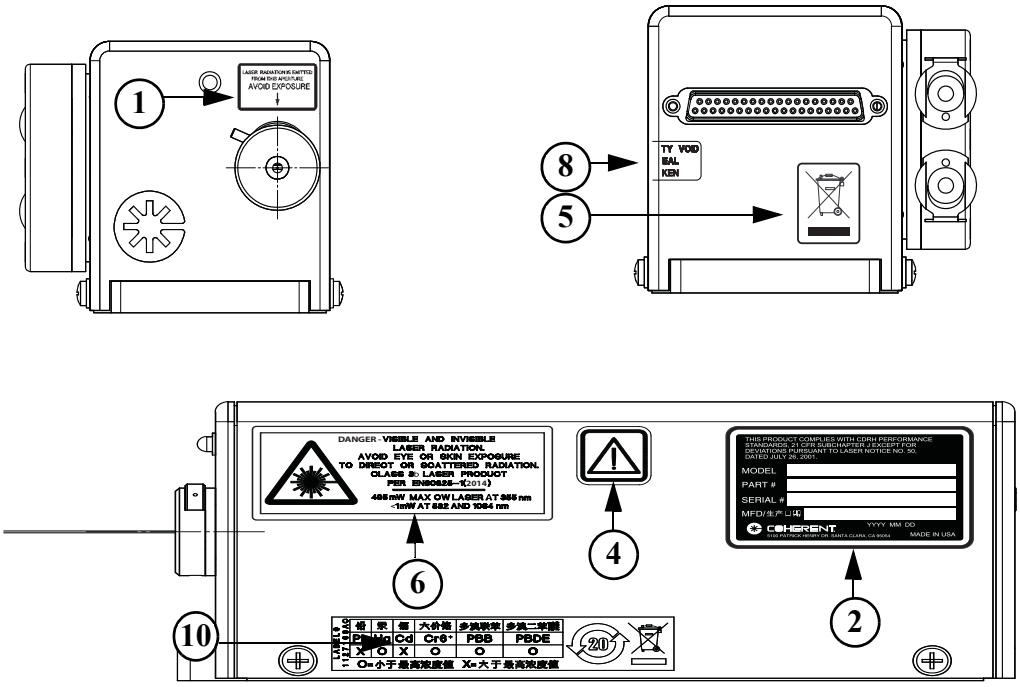
Waste Electrical and Electronic Equipment (WEEE, 2002)

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is represented by a crossed-out garbage container label. The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.



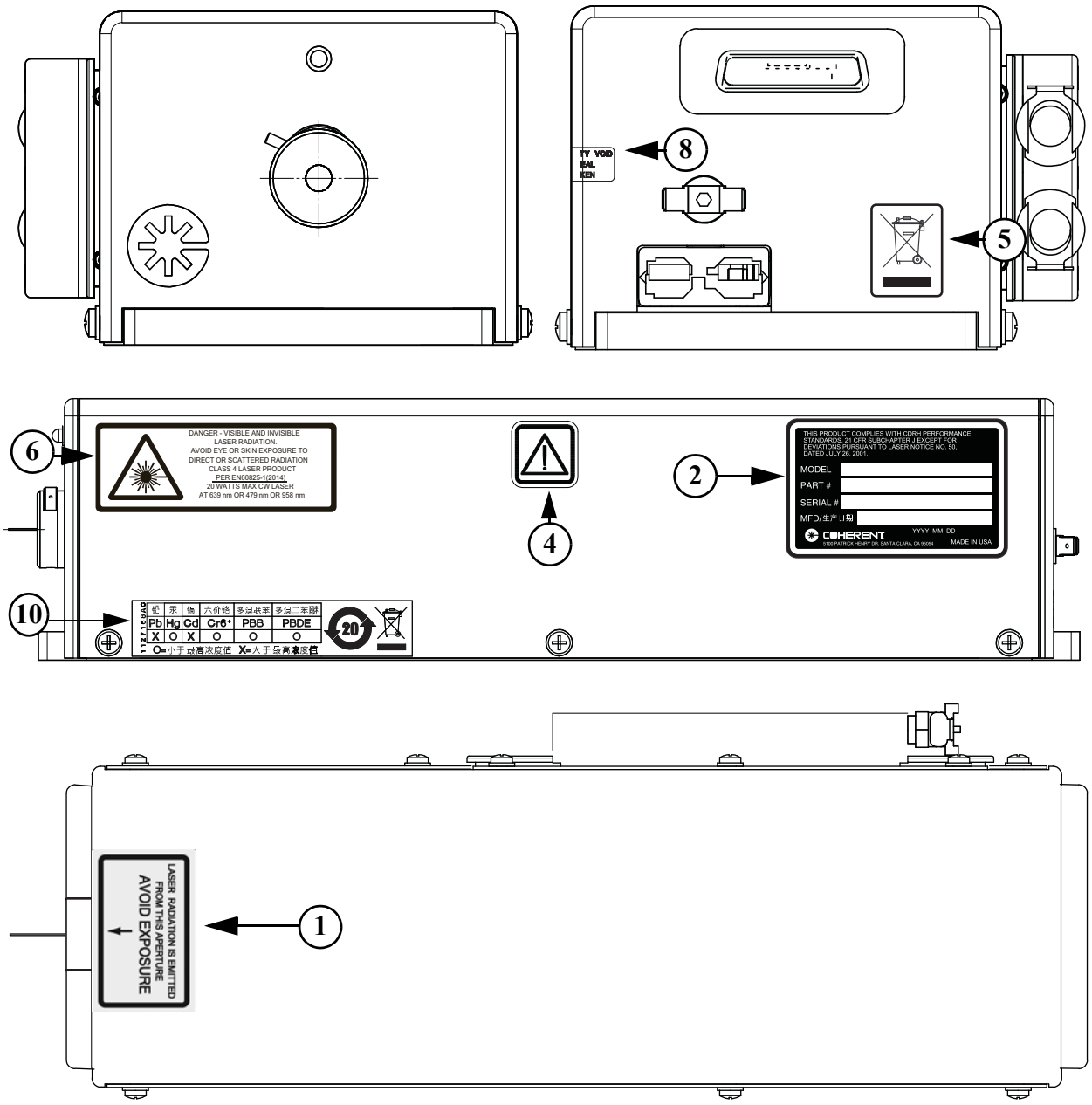


MTM Head with Air Cooled Heatsink



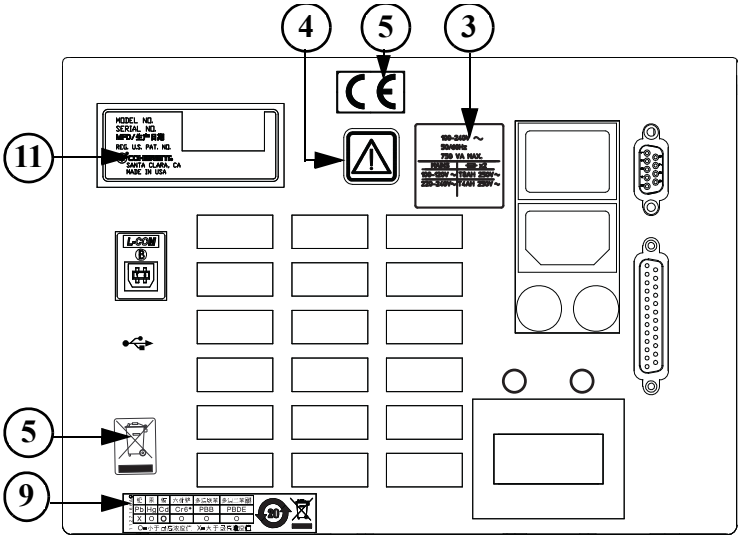
STM/SLM Head with Water Cooled Heatsink

Figure 1-1. Label Locations (Sheet 1 of 3)

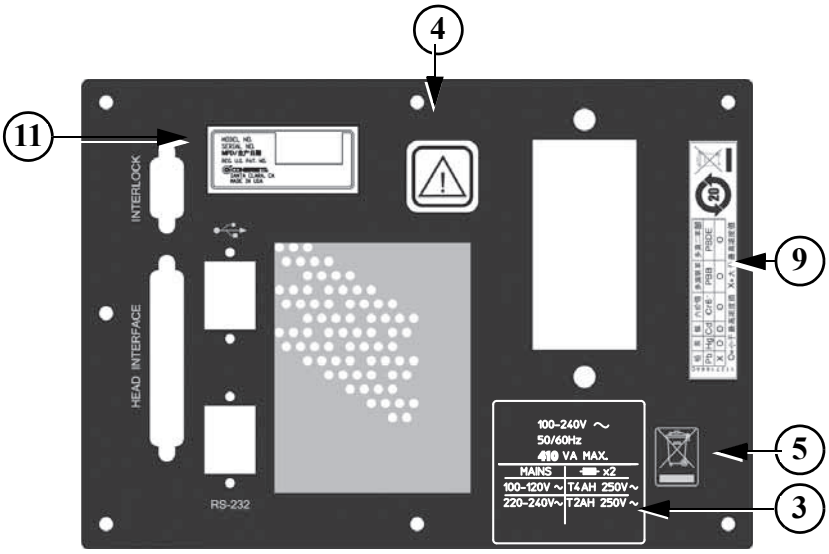


Red Head with Water Cooled Heatsink

Figure 1-1. Label Locations (Sheet 2 of 3)

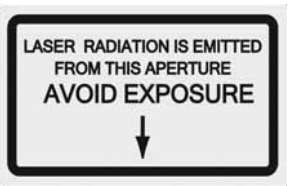


MTM Benchtop Power Supply Rear

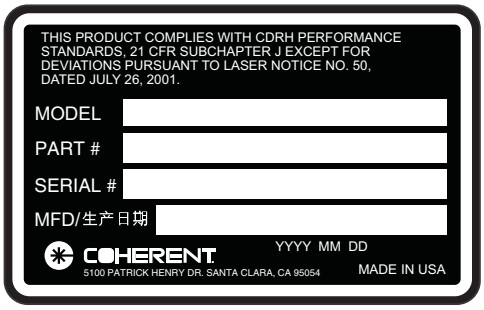


STM/SLM Benchtop Power Supply

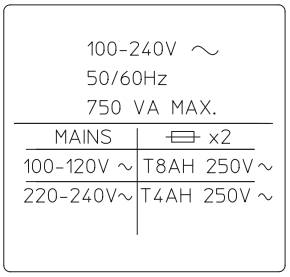
Figure 1-1. Label Locations (Sheet 3 of 3)



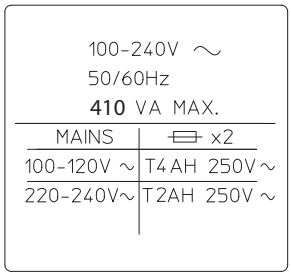
1. APERTURE WARNING



2. SERIAL NUMBER IDENTIFICATION (HEAD)



High Current Model (MTM)

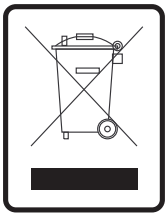


Low Current Model (STM/SLM)

3. VOLTAGE RATING SILK SCREEN

4. CAUTION MARK

Figure 1-2. Label Description (Sheet 1 of 4)



5. WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT) SILK SCREEN OR STICKER

For 532 nm (Green)

For 577 nm (Yellow)

For 460 nm (Blue)

Figure 1-2. Label Description (Sheet 2 of 4)

For 479 nm (Cyan)

For 488 nm

For 607 nm

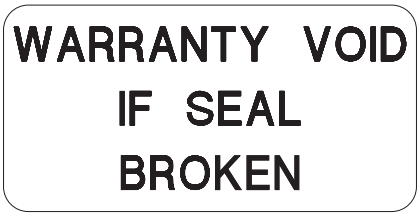
For 639 nm

Figure 1-2. Label Description (Sheet 3 of 4)

For 1064 nm

6. RADIATION WARNING

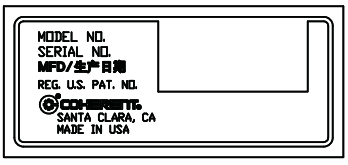
7. CE CERTIFICATION



8. WARRANTY SEAL

9. CHINA ROHS (POWER SUPPLY)

10. CHINA ROHS (HEAD)



11. SERIAL NUMBER IDENTIFICATION (POWER SUPPLY)

Figure 1-2. Label Description (Sheet 4 of 4)

MPE/NOHD Values

Genesis™ MX-STM/SLM Beam diameter: 1 mm
Beam divergence: 0.7 mrad

Table 1-1. Genesis ™ MX-STM/SLM

WAVELENGTH	POWER (MW)	MPE (W/CM^2)	NOHD (M)[A]	EYEWEAR OD
460, 480, 488, 514, 532, 561,577, 590, 607	500	$2.55e^{-3}$	319	2.708
488, 514, 532, 577, 590, 639	1000	$2.55e^{-3}$	452	3.009

a. 0.25 sec exposure duration

Genesis™ MX-MTM Beam diameter: 2.25 mm
Beam divergence: 0.5 mrad

Table 1-2. Genesis ™ MX-MTM

WAVELENGTH	POWER (MW)	MPE (W/CM^2)*	NOHD (M)[A]	EYEWEAR OD
460, 480, 488, 532, 577, 561, 639	3000	$2.55e^{-3}$	1100	3.486
480, 488, 532, 577	5000	$2.55e^{-3}$	1410	3.708
532	8000	$2.55e^{-3}$	1790	3.912
532	10000	$2.55e^{-3}$	2000	4.009
480, 488, 577	6000	$2.55e^{-3}$	1550	3.787
460, 480, 561, 607, 639	2000	$2.55e^{-3}$	895	3.310
460, 639	1000	$2.55e^{-3}$	633	3.009
607	1250	$2.55e^{-3}$	707	3.106
1064[b]	10000	$5.00e^{-3}$	1430[c]	3.716
1064[b]	12000	$5.00e^{-3}$	1560	3.716

a. 0.25 sec exposure duration
b. Used beam diameter and divergence of visible wavelengths
c. 10 sec exposure duration

Sources of Additional Information

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

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.govl

Publications and Guidelines

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

Safety of laser products - Part 14: A user's guide (British Standard)
IEC TR 60825-14

Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use
IEC 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

Equipment and Training

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

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

SECTION TWO: DESCRIPTION AND SPECIFICATIONS

System Description

The Genesis™ MX series laser is a small and robust visible and invisible laser based on Coherent's patented Optically Pumped Semiconductor Laser (OPSL) technology. The laser is offered in two versions, MTM, multi spatial mode with up to 10 Watt output power, and STM/SLM, TEM00 up to 1 W of output power.

Figure 2-1. Genesis ™ MX STM/SLM Laser and Power Supply

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

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 wavelengths by frequency doubling with non-linear crystals.

TheGenesis™ MX series laser is available as single transverse (STM) and single longitudinal mode (SLM) or multi-transverse mode (MTM).

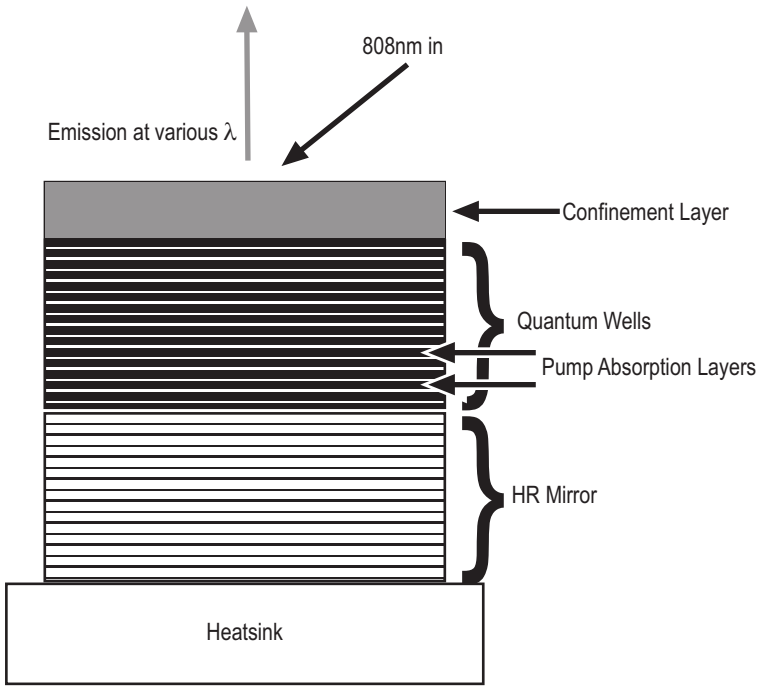


Figure 2-2. OPSL Diagram

Specifications

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

Dimensions

The dimensions of the Genesis™ MX subsystems and the Power Supply are given in Table 2-1.

Table 2-1. Utility Requirements, Dimensions and Weights

PARAMETER	VALUE
ELECTRICAL	
Operating Voltage (V_{AC})	100 – 240
Frequency (Hz)	50 to 60
Power Consumption High I (W)	500-600
Power Consumption Low I (W)	250-350
CE Mark	EN 55011 EN 61326 EN 60825 EN 61010
DIMENSIONS	
Laser Head Type[a]	LxWxH
STM/SLM (Air Cooled)	219.91 x 146.0 x 89.22 mm (8.66 x 5.75 x 3.51 in.)
MTM (Air Cooled)	265.13 x 186.42 x 95.25 mm (10.44 x 7.34 x 3.75 in.)
STM/SLM (Water Cooled)	219.91 x 100.03 x 89.22 mm (8.66 x 3.94 x 3.51 in.)
MTM (Water Cooled)	265.13 x 140.37 x 95.25 mm (10.44 x 5.53 x 3.75 in.)
Red (Air Cooled)	379.07 x 186.42 x 95.25 mm (14.92 x 7.34 x 3.75 in.)
Red (Water Cooled)	379.07 x 140.37 x 95.25 mm (14.92 x 5.53 x 3.75 in.)
Power Supply (L x W x H) Benchtop Controller	361.1 x 228.9 x 179.6 mm (14.22 x 9.01 x 7.07 in.)
Cables (laser head to controller)	1.82m (6ft)
WEIGHTS	
Power Supply/Benchtop Controller Unit Power Supply (STM/SLM)	5.9 Kg (13 Lbs.) 5.5 Kg (12 Lbs.)
ENVIRONMENTAL SPECIFICATIONS	

Table 2-1. Utility Requirements, Dimensions and Weights (Continued)

PARAMETER	VALUE
Ambient Temperature: Operating (Water Cooled) Operating (Air Cooled) Non-Operating	 10 to 40 °C (50 to 104 °F) 10 to 35 °C (50 to 95 °F) -10 to 60 °C (5 to 140 °F)
Sound Level	<80dB
Cooling Water (if chiller is not used)[b, c, d]:	10 to 35 °C (50 to 95 °F) Water flow > 1L/min (.26 gal/min)
Relative Humidity (non-condensing):	5 to 95 %[d]
Altitude	Sea level to 2000 m (6562 ft.)

a. Back connector not included in laser head length dimension
b. Warm-up time must be extended to include the stabilization time of the cooling circuit
c. Rapid variations of coolant temperature may affect noise and pointing performance
d. Non-condensing

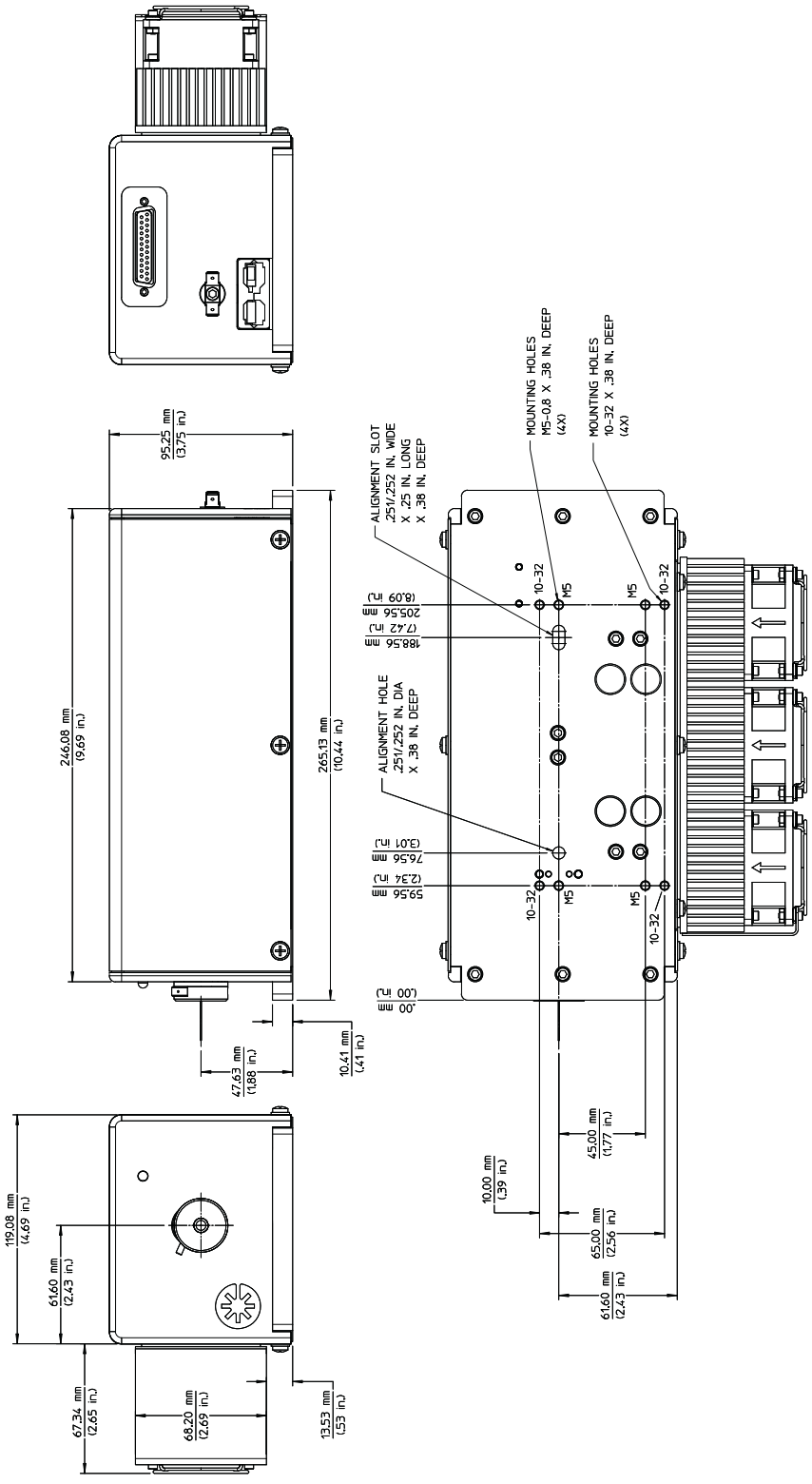


Figure 2-3. Genesis ™ MX MTM Air Cooled

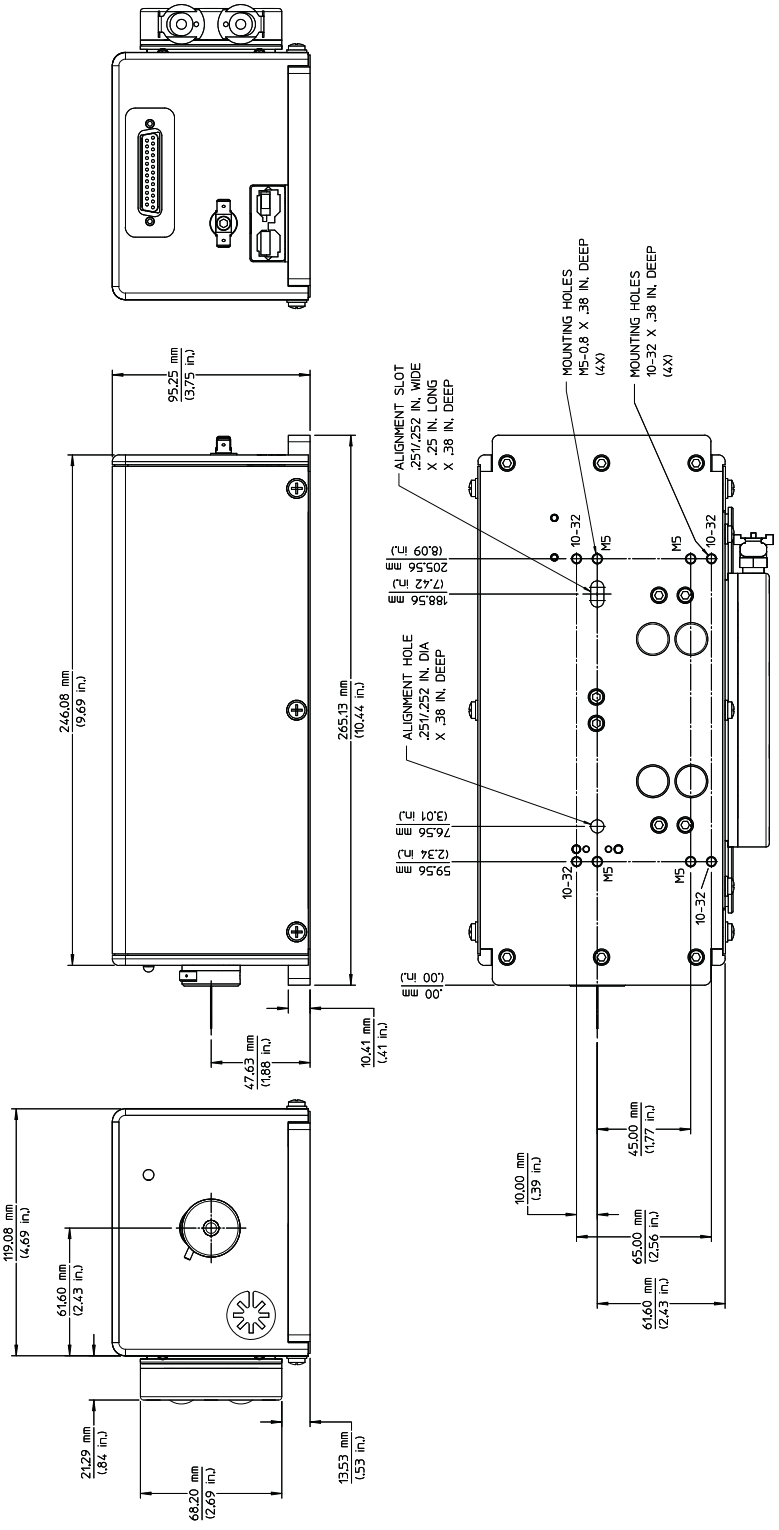


Figure 2-4. Genesis ™ MX MTM Water Cooled

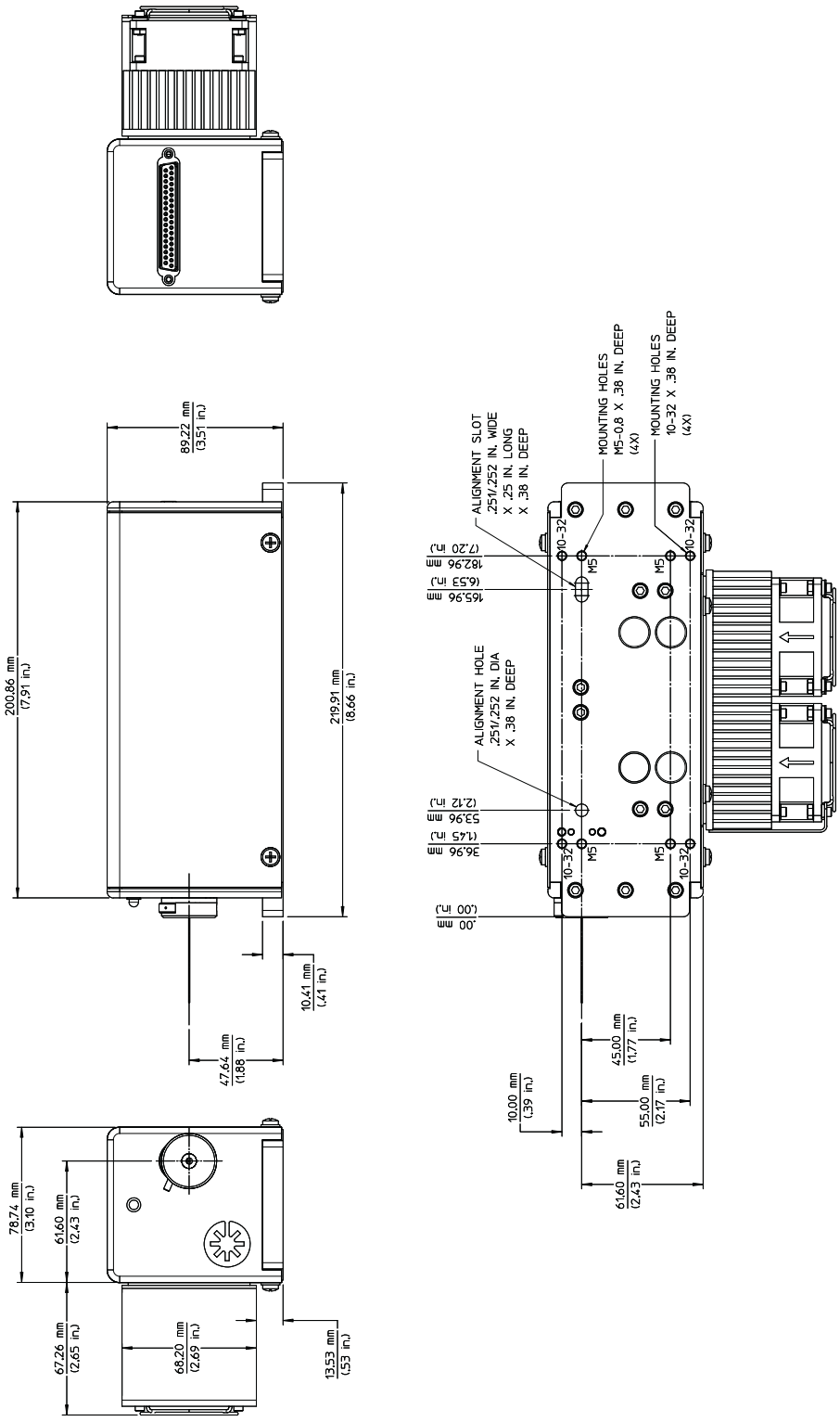


Figure 2-5. Genesis ™ MX STM/SLM Air Cooled

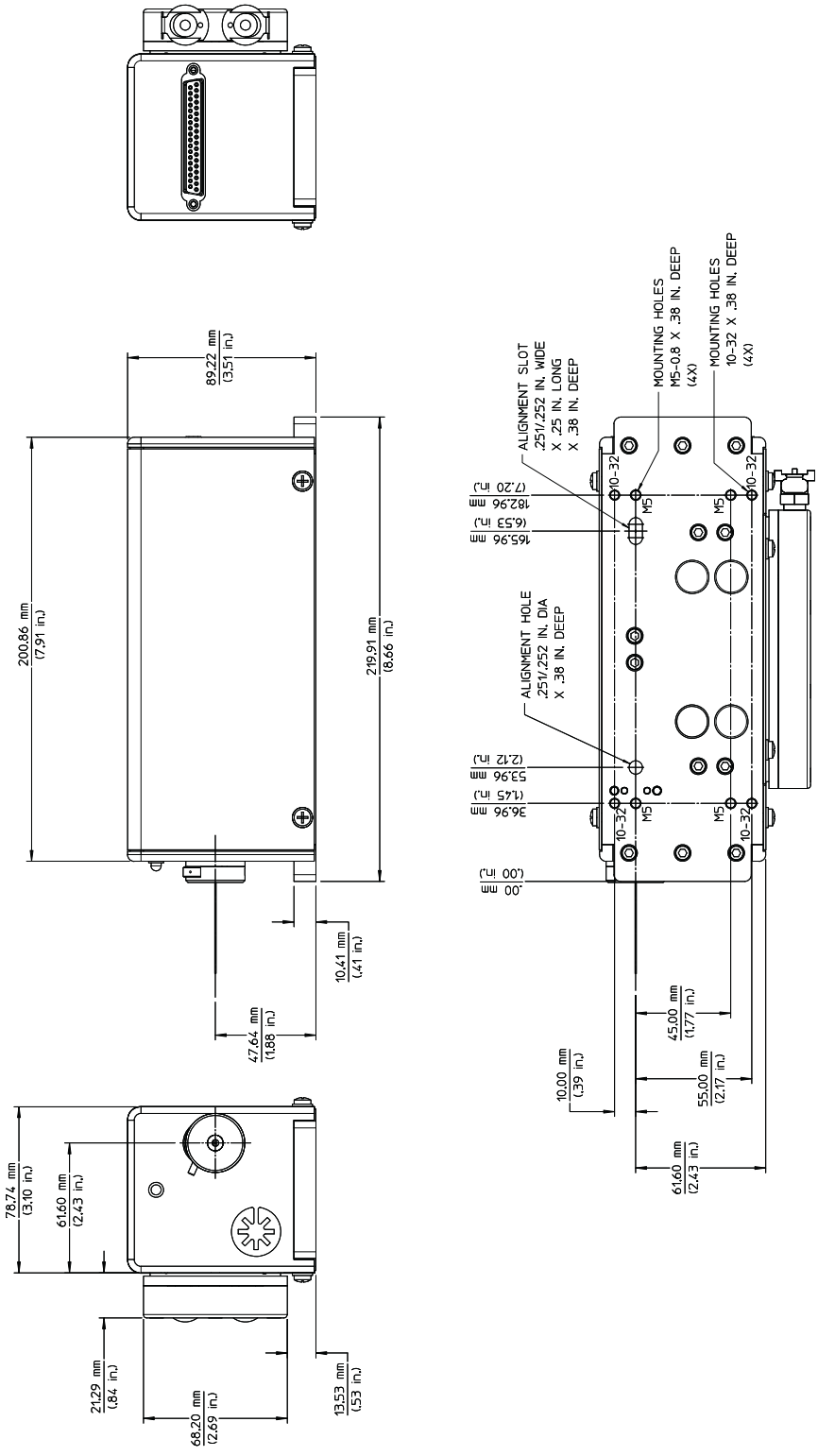


Figure 2-6. Genesis ™ MX STM/SLM Water Cooled

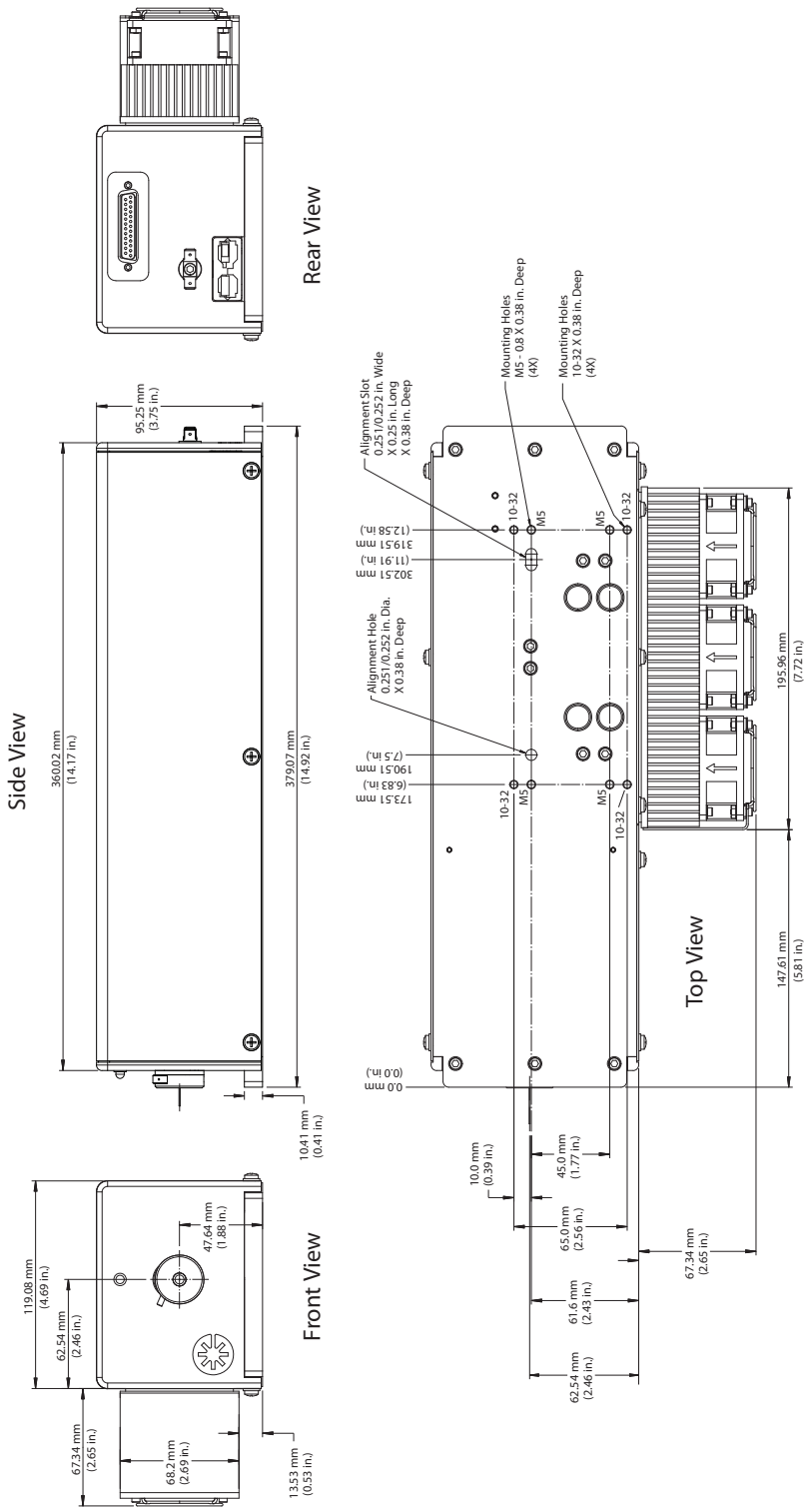


Figure 2-7. Genesis ™ MX Red Air Cooled

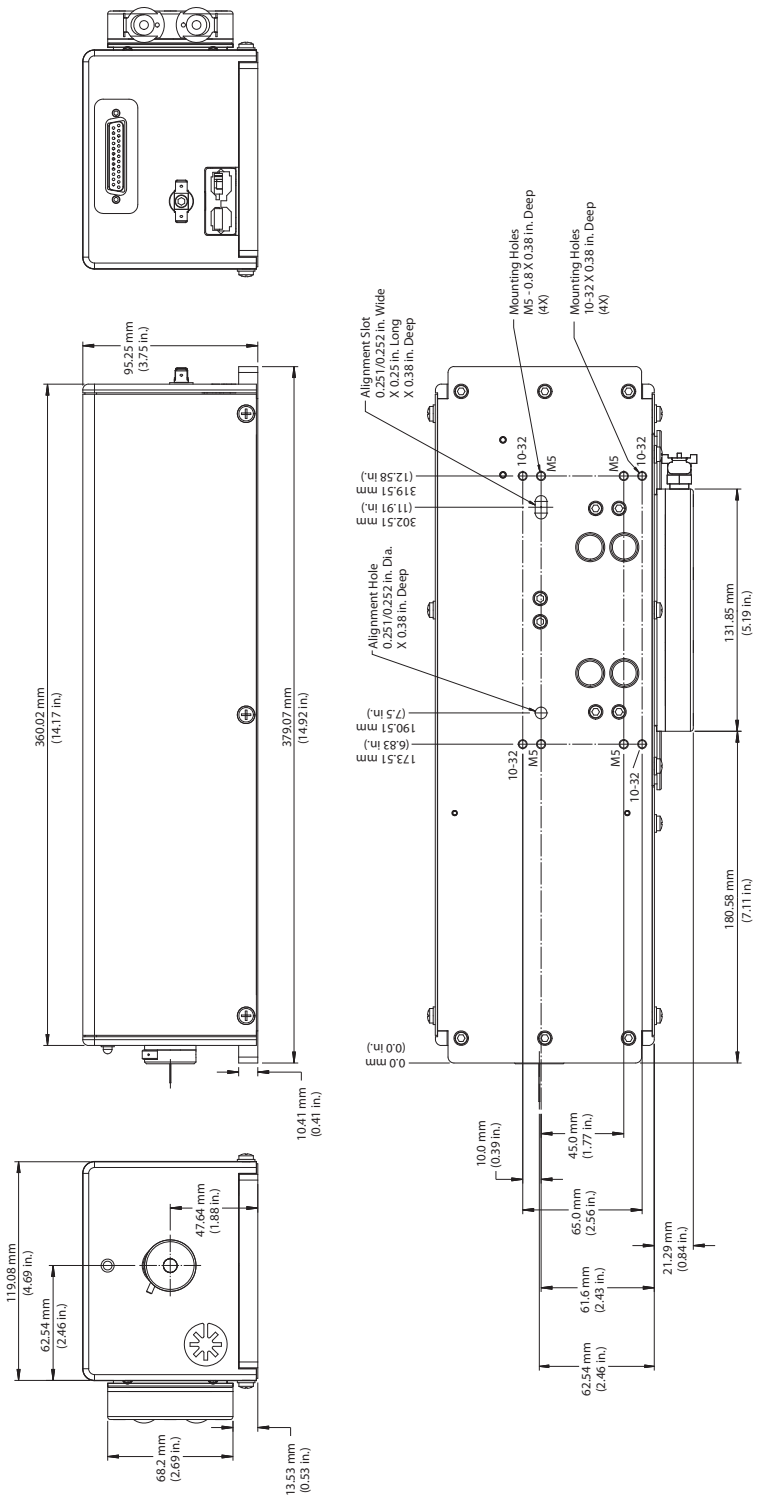


Figure 2-8. Genesis ™ MX Red Water Cooled

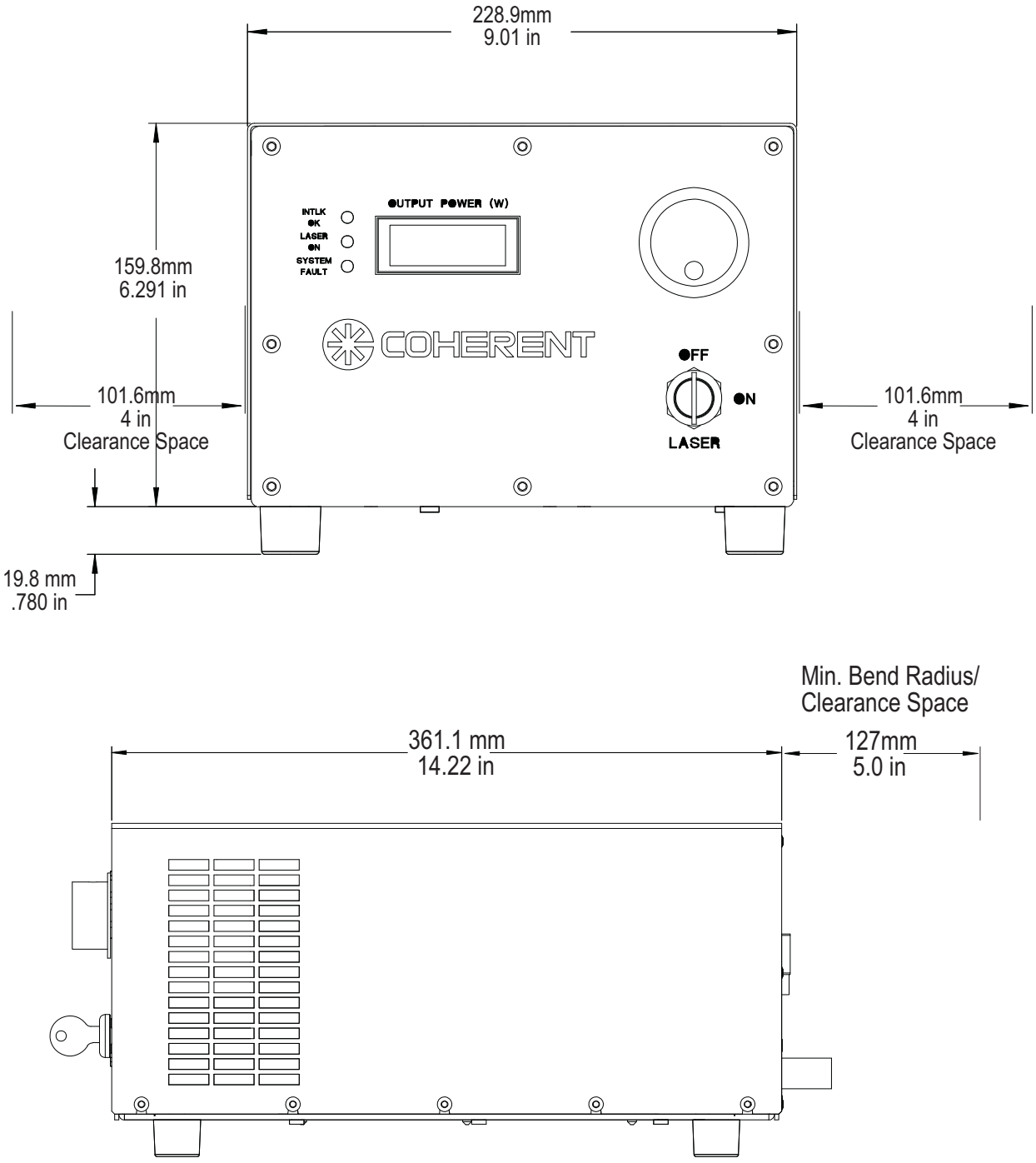


Figure 2-9. Subsystem Dimensions Benchtop Power Supply

SECTION THREE: INSTALLATION

Receiving and Inspection

Inspect shipping container for signs of rough handling or damage. Indicate any such signs on the bill of lading. Report any damage immediately to the shipping carrier, and to Coherent Order Administration Department (800-438-6323) or to an authorized Coherent representative.

NOTICE!
Retain shipping containers. The containers will be required if the system is returned to the factory for service. The containers may also be needed to support a shipping damage claim.

The installation procedure includes the following steps:

- Connect the system power to a properly grounded AC outlet.
- Connect the system components.
- Connect means of remotely controlling and monitoring the laser system (Optional).

The tasks above are described in the following paragraphs. After performing all of the tasks, the laser may be turned on and operated in accordance with “Section Four: Operation” on page 4-1.

Contents of the Shipping Container

The Shipping Container contains the necessary hardware for Genesis™ MX series laser installation. See Figure 3-1 for details.

Laser (MTM) head shown with water cooled heatsink. Clamp not included.

Bench Top Power Supply

Figure 3-1. Installation Kit (Sheet 1 of 3)

Water Hose Kit (If ordered with a Water Cooled Heatsink Riser)

Control Cable (MTM only)

USB Cable

Figure 3-1. Installation Kit (Sheet 2 of 3)

AC Power Cable

Diode Power Cable (MTM only)

a. The diode power cable comes in different gauges depending on the output power of the laser.

Diode Power and Control Cable (STM/SLM only)

Figure 3-1. Installation Kit (Sheet 3 of 3)

Interconnections

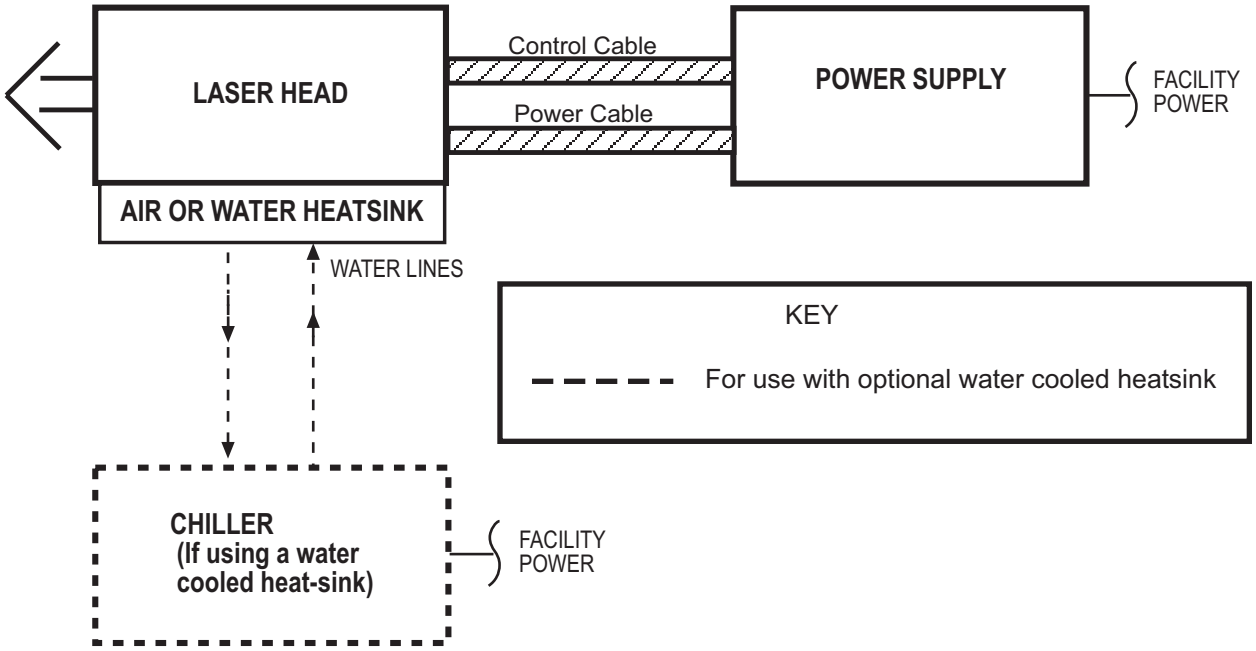


Figure 3-2. Interconnection Diagram for MTM Head

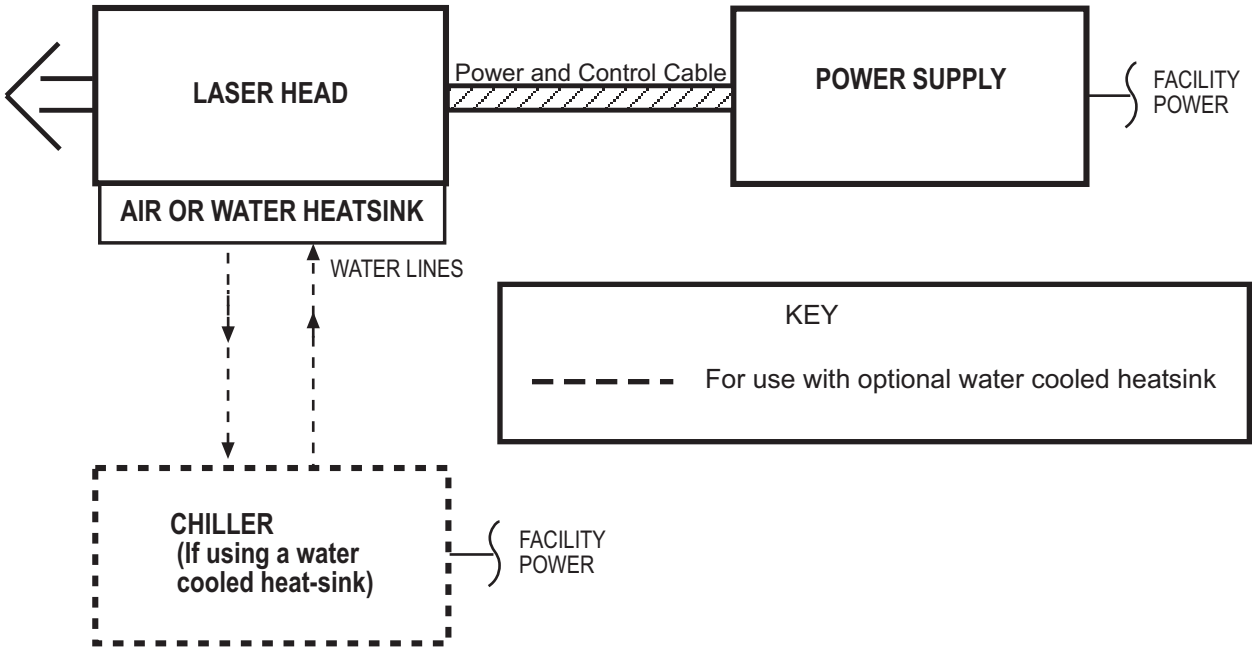


Figure 3-3. Interconnect Diagram for STM/SLM Head

Installing the Power Supply

NOTICE!
The Genesis ™ MX laser head and power supply are mated at the factory for optimal performance. They are NOT interchangeable. DO NOT switch power supplies with other heads. Doing so may reduce performance and/or shorten the lifespan of the laser head.

1. Move the power supply to user accessible location, preferably away from heat producing sources. Ensure the cooling intake and exhaust (rear, right, and left side) are free of obstruction. Leave a minimum of 4 inches in clearance space on the sides and 5 inches in the rear of the power supply.

NOTICE!
The system will not operate with the interlock open. For additional information on the interlock, including the connection of an external interlock circuit, refer to the paragraph titled, "External Interlock" on page 3-11.

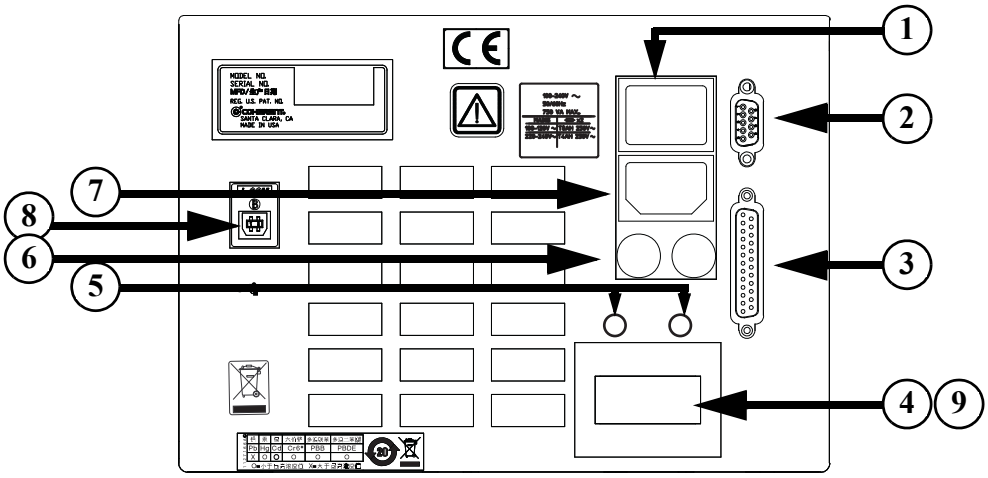
2. Connect the AC power cord on the rear of the power supply in the location shown in Figure 3-4. Do not connect the AC power cord to the facility power outlet at this time.

   Each customer must inspect the power cord and install the proper connector if necessary. The connector should be installed in a properly grounded outlet with a maximum of:

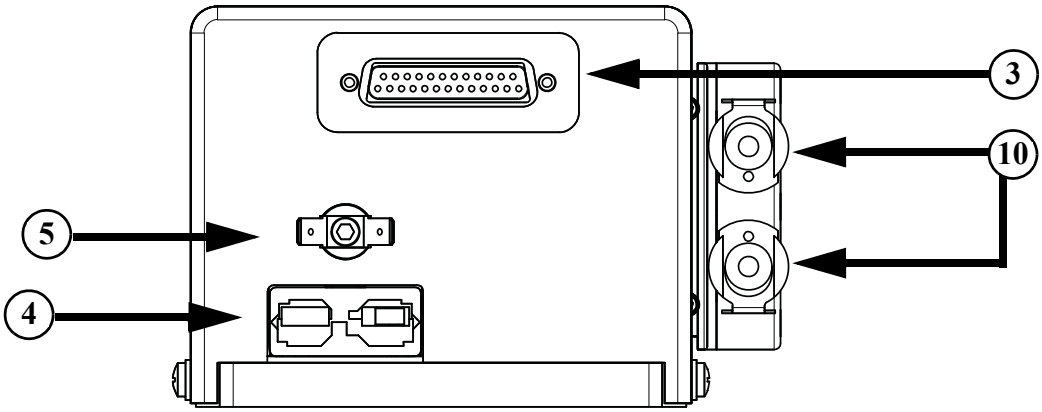
   - 8A@ 120V (MTM)
   - 4A@ 220V (MTM)
   - 4A @ 120V(STM/SLM)
   - 2A @ 220V(STM/SLM)

   for proper overcurrent and earth fault protection.

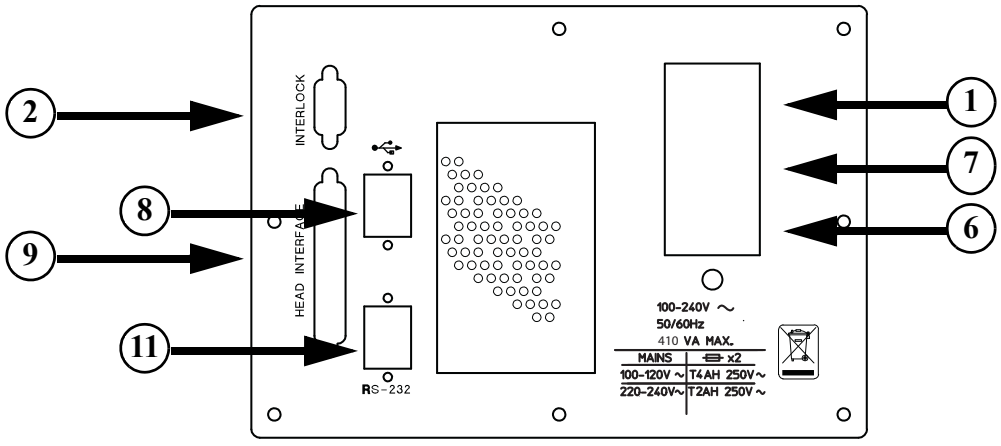
3. Check the fuses.
4. Proceed to the paragraph titled, "Installing the Laser Head".



Power Supply Back Panel for Genesis ™ MX MTM

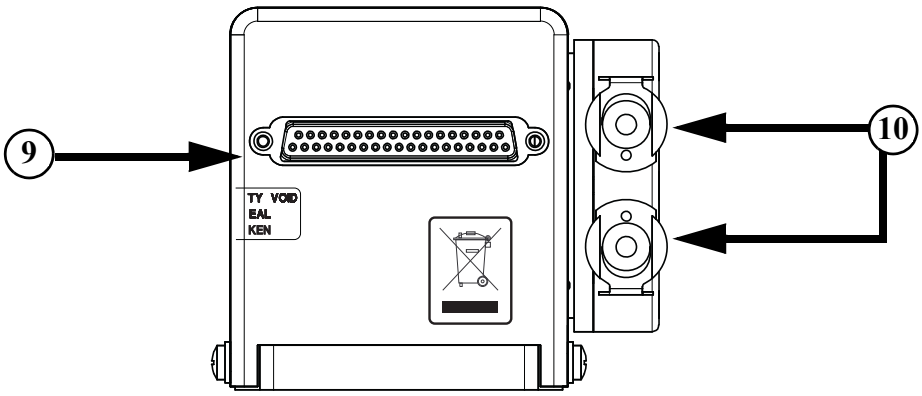


Genesis ™ MX MTM Head with Water Cooled Heatsink



Power Supply Back Panel for Genesis ™ MX STM/SLM

Figure 3-4. Connection Locations



Genesis ™ MX STM/SLM Head with Water Cooled Heatsink

1. Power On/Off Switch
2. External Interlock/ Back Panel Connector
3. MTM Head Control Connector
4. MTM Diode Power Plug Connector
5. Ground pin connectors
6. Fuses
7. AC Power Plug Connector
8.USB Connector
9.STM/SLM Head Control and Power Connector (Shorting Clip for head not shown)
10. Cooling water line quick disconnect
11. RS-232 Connector

Figure 3-4. Connection Locations (Continued)

Installing the Laser Head

NOTICE!
If the laser head is ordered with either an air or water cooled heatsink, the head and heatsink are shipped pre-attached. The temperature of the laser head is monitored by the Genesis™ MX power supply and can be displayed on the computer control software. The Genesis™ MX will shut down if the internal temperature exceeds safe operating conditions.

WARNING!
The unit must be powered off before connecting/disconnecting these cables.

NOTICE!
The following ESD precautions are required to prevent damage to the laser when the power shorting jumper is not installed in the laser and the laser is not connected to the power supply with the power cable.

1. Connect the AC power cord of the power supply to a grounded AC outlet.
2. Use user supplied clamps and bolts to secure the system to a grounded optical table as shown in Figure 3-5.

Figure 3-5. Secure System to Optical Table [a]

a. Rear clamp and bolt not shown. Clamps and bolts not included.

3. Ground the body of the operator using an appropriate ESD wrist band and grounding cord attached to the optical table. For Genesis ™ MX MTM continue on to Step 1. For Genesis ™ MX STM/SLM, skip to Step 1.

For Genesis ™ MX MTM

1. Connect two flying ground leads of the diode power cable (APP SB50) to the Power Supply.

Both green/yellow and black leads are ground leads and are interchangeable

Figure 3-6. Flying Ground Leads

2. Connect the diode power plug of the power cable (APP SB50) to the Power Supply. Make sure the connector is completely pushed in.
3. Connect the two flying ground leads to the laser head.
4. Remove the shorting jumper from the laser head.
5. Connect the diode power plug of the power cable (APP SB50) to the laser head. Make sure the connector is completely pushed in.

WARNING!
The unit must be <u>powered off</u> before connecting/disconnecting the control and /or power cable.

6. Connect the control cable (DB25 male connectors) to the laser head and power supply. Skip to Step 2.

For Genesis ™ MX STM/SLM

1. Connect the laser head to the power supply using the STM/SLM Head Control and Power Connector

2. If the water-cooled heatsink was ordered, use the water line hardware (Figure 3-1) to connect the heat sink to the chiller or house water line (Figure 3-4).
3. If using a chiller, fill and prepare the chiller in accordance with the chiller user's manual. Turn chiller on, set it to 20 °C and check the system for leaks.
4. Confirm the chiller is on and running, then turn the system on using the switch in the back panel of the power supply.
5. The System Fault (red) LED will stay on for a few minutes until the internal components reach safe operating temperature. The Interlock OK (yellow) LED will illuminate once the system is ready to use. The Interlock OK LED will remain on during normal operation.

Interlocks

External Interlock

The system is shipped with a back panel interlock connector (see Figure 3-4 and Figure 3-7). The laser will not operate without the interlock connection in place, and the system will not operate with any of the interlocks open. The interlock status is monitored by the internal electronics. If the interlock is open, laser emission will terminate, and the SYSTEM FAULT LED (Red) will illuminate. Ensure the external interlock shorting connector or user-furnished interlock is installed prior to turn on.

To incorporate an external safety interlock circuit into the laser system, turn off the laser and remove the interlock plug from the back panel of the power supply. Attach a user furnished external interlock circuit to this connector. Any external interlock circuit should be equivalent to a mechanical closure of the circuit. When the interlock is opened, the unit will terminate laser emission.

Table 3-1. External Interlock Pin-outs

FUNCTION	PINS	DESCRIPTION
Interlock	1 & 2	Intended for remote termination of laser emission for safety reasons. Opening the interlock circuit creates a fault condition that can only be cleared by closing the circuit and cycling the key (enable circuit)
Enable	6&7	Intended for remote replication of the key switch. A switch placed between these pins will be connected in series with the key switch.

Analog Control/ Interlock

The laser can also be remotely controlled by means of suitable signals at the interlock connector, as shown in figure Figure 3-7.

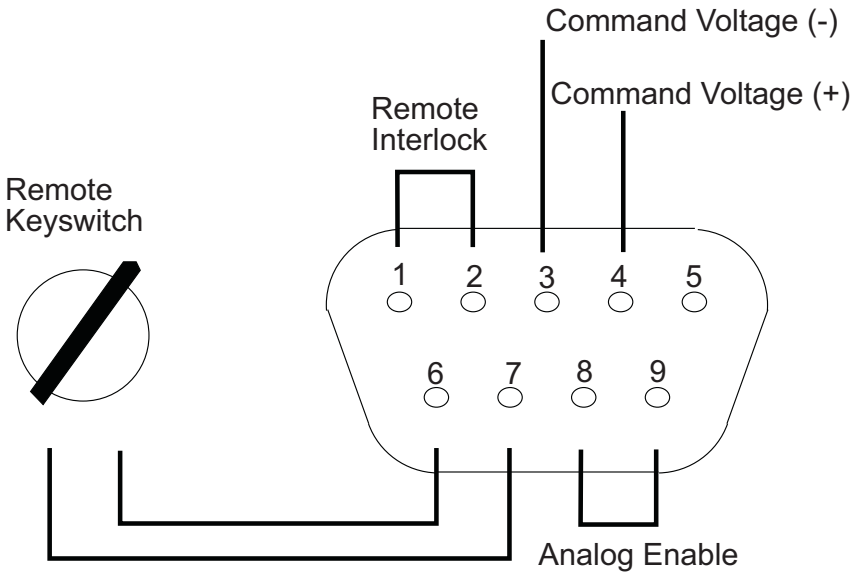


Figure 3-7. Interlock Connector

- The Remote interlock pins 1 & 2 need to be shorted, either at the connector or from a remotely located safety switch.
- The function of the key-switch on the unit can be replicated remotely by connecting a switch to pins 6 & 7. This connection is in series with the key-switch on the unit; both need to be closed for the laser to be enabled.
- The command voltage will be ignored unless it is enabled by shorting pins 8 & 9.
- V-I conversion is 5V=100A in Current Mode for MTM.
- V-I conversion is 5V=20A in Current Mode for STM/SLM.
- V-P conversion is 5V=Full Scale if in Power Mode[1].
- Maximum current and power are set by the factory and cannot be overridden with analog control.

1. Full scale is reported in the customer data sheet shipped with the system.

Computer Control (Optional)

Installation:

1. Insert the supplied CD in the computer (Windows XP and 2000 compatible). For USB control, perform steps Step 2 through Step 5 below. For RS232 control, skip to Step 6.
2. Power up the laser and connect the USB cable to the computer. Shortly afterwards the system will recognize a new device and the "Found new hardware" wizard window will open.
3. Decline the option to connect to windows upgrade see Figure 3-8

Figure 3-8. Decline Option

4. Select the option to look for drivers in a specific location, see Figure 3-9.

Figure 3-9. Software Location

5. Browse to the location of the driver folder in the CDM 2.04.06 WHQL Certified, see Figure 3-10.

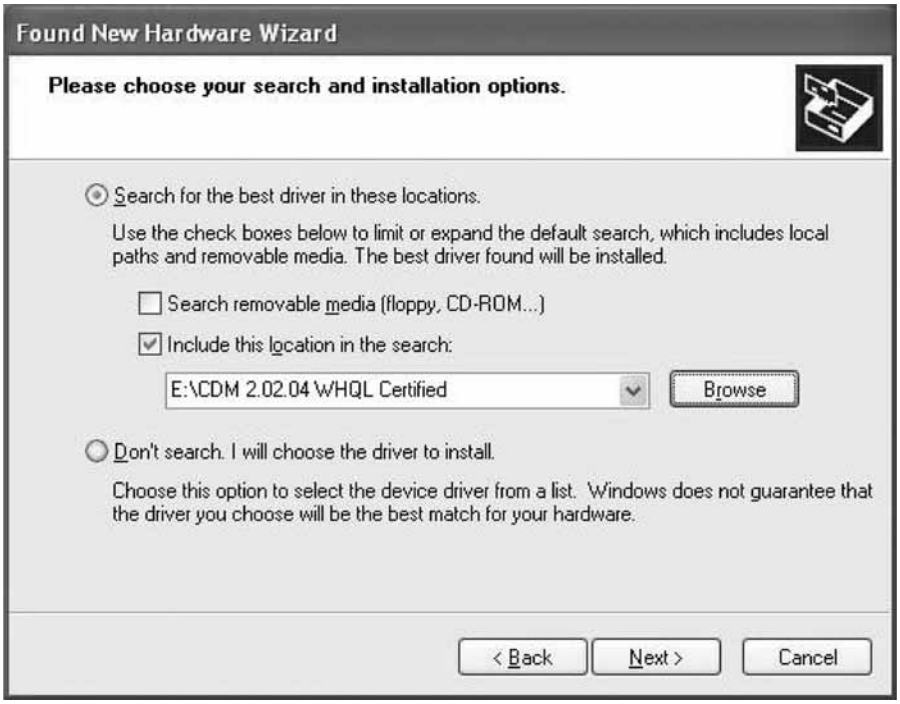


Figure 3-10. Driver Location

6. After clicking Next>, the installation of the drivers is complete, the next step is the installation of the software.

For software installation run the "setup.exe" program on the CD. This triggers the execution of two installation wizards.

- The first one installs the OPSL laser control software and the control DLLs necessary for user developed laser control software.
- The second one starts automatically after the first one is complete and installs the Labview runtime routine, necessary for the OPSL laser control program

SECTION FOUR: OPERATION

Operation

After all steps in the installation section have been completed, and the internal temperatures have reached safe operating conditions, the laser is ready for operation.

DANGER!
Wear laser safety glasses to protect against the radiation generated from the laser. It is assumed that the operator has read Section One: Laser Safety, and is familiar with laser safety practices and the dangers involved. All personnel in the area must be wearing laser safety glasses.

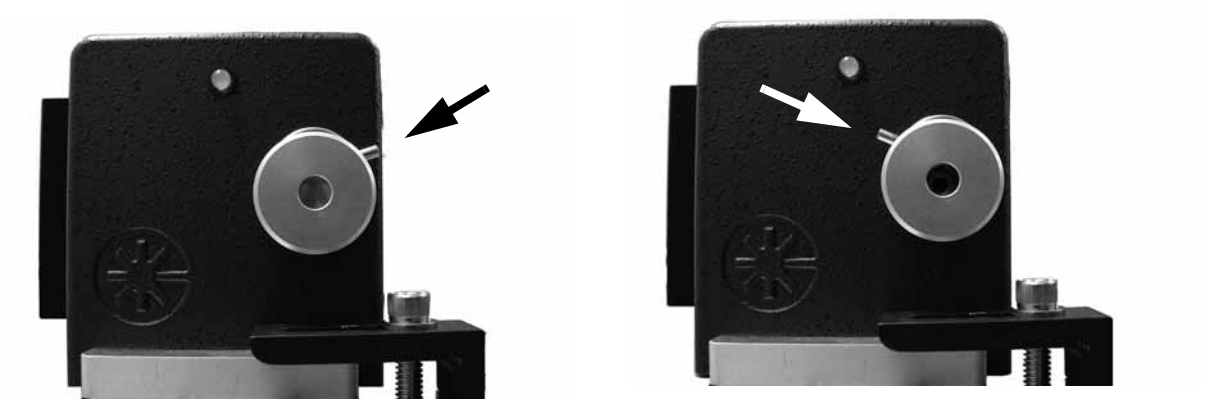
NOTICE!
When performing a cold-start, the key switch of the power supply must be in the off position before AC power is applied. Failure to follow this order will result in a fault, indicated by all three LEDs on the power supply eventually turning on and the laser remaining off. The key switch will need to be turned off and back on to start the laser.

NOTICE!
When turning the key switch on at cold-start, give the laser time to come up to operating temperature. While the laser is coming up to operating temperature, the Interlock OK LED and System Fault LED may oscillate until the system is ready to lase. When the system is ready to lase, the System Fault LED will turn off and the Interlock OK LED will remain on. Turning the key switch on prior to the laser coming up to operating temperature will result in a fault. The fault can be cleared only by turning the key switch off, and back on, provided that the laser has come up to operating temperature.

Front Panel Operation

The control knob and power indicator display on the front panel of the power supply allow operation without a computer.

1. Open the shutter.



Shutter Closed

Shutter Open

Figure 4-1. Shutter Positions

2. Turn the keyswitch on the power supply front panel to ON.
3. Wait 5 seconds. The LASER ON LED will blink during the safety delay period. Low level visible radiation will be emitted at this point.
4. Turn the control knob to reach the desired power. Refer to the data sheet shipped with the system.

Pushing the control knob in while turning provides coarse adjustment
The command power will reset to zero when the keyswitch is turned off.

LED indicators

The power supply front panel has three LEDs to indicate the status of the laser system, and a key switch used to enable laser operation.

Interlock OK (yellow): This indicator lights up when the interlock circuit is closed, this happens only when both of the following conditions are met

- The user has closed the external interlock loop by means of an external switch or using the supplied shorting connector.
- The internal sensors indicate that the laser is ready to be used.

Note that it takes a few minutes for the internal components to reach safe operation temperature, the interlock OK indicator will normally be off when the unit is first powered up.

The emission indicator on the laser head is connected to the same circuit.

Laser ON (Green): This indicator lights up when the laser diode driver is enabled, and laser radiation is being emitted. The indicator blinks during the safety delay period after the keyswitch is turned on.

System Fault (Red): This indicator lights up when an unsafe condition has been detected and the laser has been disabled. It lights up when the interlock loop is open. If an unsafe situation occurs during operation, the error condition latches and it can only be cleared by cycling the keyswitch off.

Control

In addition to the front panel command knob, the laser can be remotely controlled through two different interfaces.

- Full computer control through USB or RS232 interface
- Analog control capability through control pins at the interlock connector

Two actions are required to operate the laser; the laser needs to be enabled, and a command must be given to indicate the desired output power.

Enable Switch

The power supply has three independent enable switches:

- The key-switch on the panel
- Pins 6 & 7 in the interlock connector
- A software switch (closed by default from cold start)

Due to safety considerations the different enable switches are connected in series, the laser is only enabled if all three switches are closed.

If the switches are enabling the laser when the unit is powered up, a fault condition is created and the laser will not turn on. In order to enable the laser the enable circuit needs to be cycled off and on again. This can be achieved from any of the three enable switches (key-switch, remote enable and software switch)

Power Command (for MTM Versions)

The power supply has two independent command selectors:

- A software selector (defaults to local control at cold start)
- Pins 8 & 9 in the interlock connector

Table 4-1. Command Selection (MTM)

COMMAND SELECTION		
Analog Enable (8 & 9)	Local (default)	Remote
Pins Open (default)	Laser takes command from front panel	Laser takes command from the USB interface
Pins Shorted	Command is sum of front panel and input on pins 3 & 4	Command is sum of USB command and input on pins 3 & 4

The system retains the settings selected using the software tools even after disconnecting from the computer, but only until the power is cycled; in that case, the settings return to the default settings.

Power Command (for STM/SLM Versions)

The STM/SLM power supply does not have software command selectors, the only available command selector is at the interlock interface and it is used to enable the external analog input.

Table 4-2. Command Selection (STM/SLM)

ANALOG ENABLE (8 & 9)	POWER COMMAND
Pins open (default)	Laser takes command from the sum of the front panel and computer interface[a]
Pins closed	Laser takes command from the sum of the front panel, computer interface and input on pins 3 & 4

a. Note that this configuration allows the laser to be programmed to automatically go to a set power level at key on.

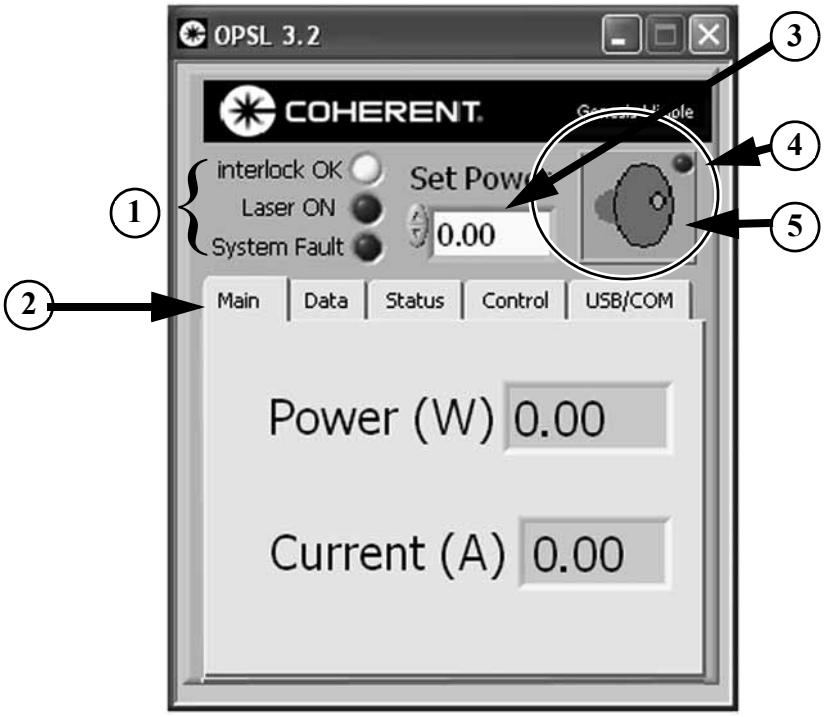
The OPSL software indicates this by ignoring attempts to toggle the Local/Remote button. Because of hardware differences the "Analog ON" indicator is always on, regardless of the status of the pins at the interlock interface.

OPSL GUI (Graphical User Interface)

With the power supply connected to the computer through the USB interface, run the OPSL program. The program window will open as shown in Figure 4-2.

- The status LEDs replicate the real ones on the front panels of the system.
- The Key-Switch in the GUI acts both as a control and as an indicator.
  - As a control, it can be used to turn the laser on and off, if the key-switch at the power supply is turned on.
  - As an indicator, the key-switch picture changes to reflect the enabled status of the laser.
- The desired power can be typed in the power command window. This control is grayed and disabled if the control of the unit is selected as "local" (as opposed to "remote").
- The tabs provide access to different functions of the program.

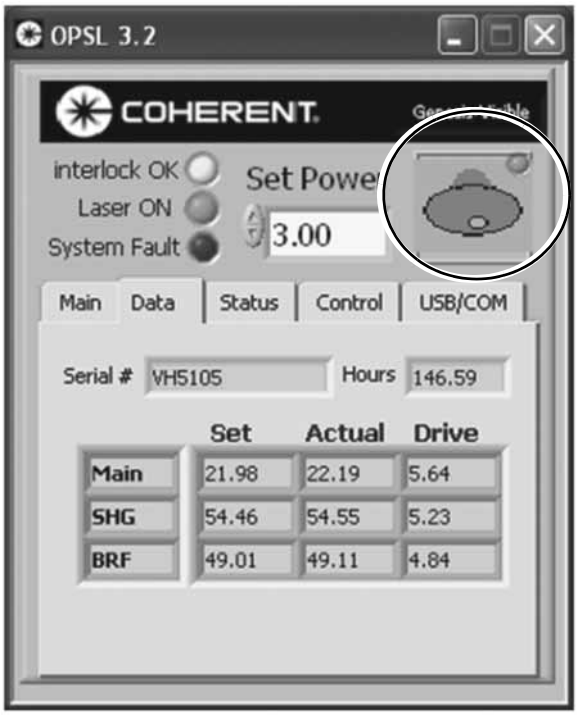
Note: It is good practice to take and save screen shots at initial installation. Screen shots can be compared at a later time for trouble-shooting.



MAIN: BASIC INFORMATION: THE POWER AND CURRENT AT ANY GIVEN TIME. NOTE KEY POSITION IS OFF.

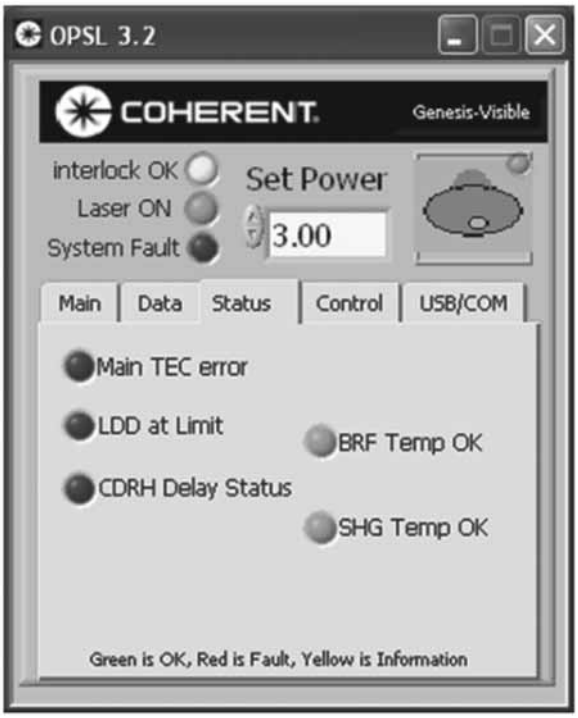
1. Status LEDs
2. Tabs
3. Power Command Window
4. Software Key Status
5. Software Key

Figure 4-2. Program Window (Sheet 1 of 5)



DATA: PARAMETER VALUES FOR SERIAL NUMBER, HOURS OF OPERATION, SET POINT AND ACTUAL TEMPERATURES AND DRIVE VOLTAGE ARE SHOWN. NOTE KEY POSITION IS ON.

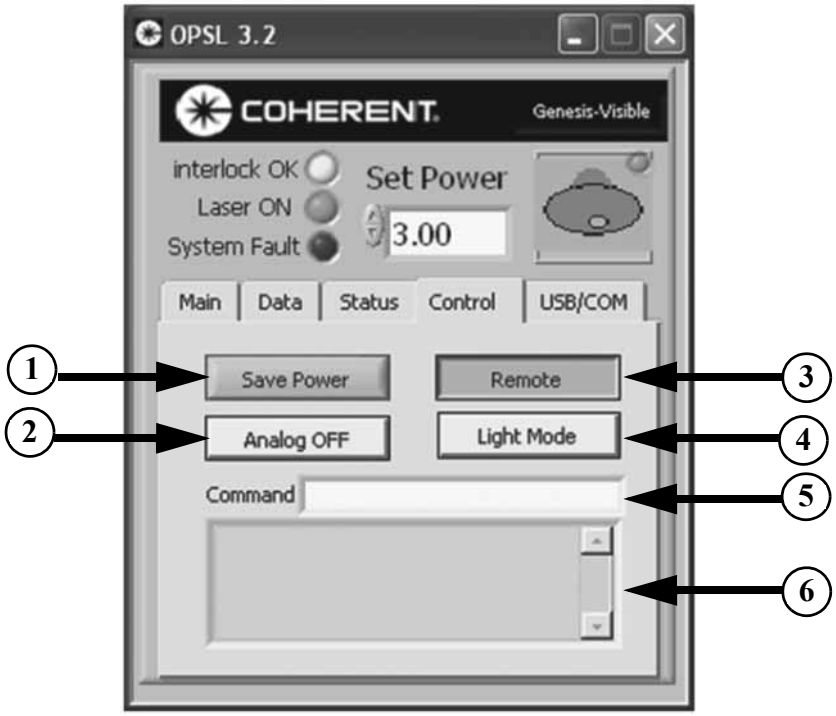
Figure 4-2. Program Window (Sheet 2 of 5)



STATUS: STATUS INDICATORS FOR DIFFERENT INTERNAL SYSTEMS OF THE LASER.

Dark Green = OFF	Red = Fault
Light Green = OK	Yellow = Look for more information using the command window on the control tab.

Figure 4-2. Program Window (Sheet 3 of 5)



CONTROL: ADVANCED CONTROL FUNCTIONS AND INDICATORS, INCLUDES THE POSSIBILITY OF SENDING RAW COMMANDS TO THE LASER. USE QUERY COMMANDS FROM TABLE 4-8 IN THE COMMAND FIELD; RESPONSES APPEAR IN THE FIELD BENEATH IT.

1. Save Power Button

Pressing this button will store the currently commanded set power in non-volatile memory, making it the default AC on commanded power.

2. Analog ON/OFF indicator, the status changes when the appropriate connections are made in the external interlock connector.

3. Remote/Local Button, changes control between remote and local (always remote for STM/SLM version)

4. Light/Current Mode Indicator, changes to desired mode when the proper command is entered into the Command Window. The key switch must be in the OFF position before switching between Photo Mode and Current Mode. An "Invalid Data" DLL fault-code may otherwise occur.

5. Command Window, use query commands from Table 4-8.

6. Response Window, use Table 4-10 for the key to the binary fault code

Figure 4-2. Program Window (Sheet 4 of 5)

USB/COM: FUNCTIONS DEALING WITH THE USB AND RS232 INTERFACES.

The program will automatically go to this tab if there is any communication problem. The GUI can be used to control several lasers through the usb or serial interfaces. The controls on this tab are used to manage communication with the lasers.

"Refresh usb list" - When the program is first started it looks for lasers connected and creates a list. If the GUI is already running when the first laser is connected, the list will contain only one laser. Press this button after connecting or disconnecting any laser through the usb interface to force the list of lasers to match the lasers actually connected.

"Open/close serial" - Use this button to connect/disconnect a serial capable controller through the serial interface. This adds/removes a laser to the list and is necessary to direct the handshake routine to a specific serial port, and to prevent the program from sending commands after a laser has been disconnected.

"Laser list pulldown" - The list of lasers connected is displayed as a pulldown menu. The GUI can communicate with one laser at a time. Use the pulldown menu to select which of the connected lasers the GUI command/queries and indicators are addressed to. The number displayed in parenthesis is the usb "handle" that Windows assigns to a particular usb device as a means of identifying it.

Figure 4-2. Program Window (Sheet 5 of 5)

CohrHOPS.DLL

The installation program copies several files in the installation directory, among them a Windows DLL file containing functions to control the laser. The DLL can be called from user programs written in any language. A Labview library with calls to the DLL is included for convenience of users creating Labview VIs.

Notes:

- The DLL is written in Visual Studio 2005 C++ without using .NET Framework for wider compatibility.
- Maximum number of devices=20.
- Strings are character arrays of length=100.

Table 4-3. Files

FILE	DESCRIPTION
CDM 2.02.04 WHQL Certified.	Folder in the CD containing USB device driver to be installed by "Found New Hardware"
CohrFTCI2C.DLL	USB functions
CohrHOPS.DLL	This DLL
CohrHOPS.H	C/C++ header file for this DLL
HOPS.llb	Labview (Version 6.0) library containing calls to the DLL

GETDLLVersion

This function returns the DLL version. Version string is up to 100.

Table 4-4. GETDLLVersion

DECLARATION	
INT32 GetDLLVersion(LPSTR version)	
PARAMETER DESCRIPTION	
return value	always 0
output: version	DLL version string. (For example: "CohrHOPS 1.0.0")
EXECUTION TIME	
Fast	

CheckForDevices

This function updates the list of USB Coherent HOPS Power Supplies found. The ordering of handles in the array may change if devices are detached and reattached. There is no report if a device's USB cable is detached and then re-attached between calls to CheckForDevices. Similarly, there is no report if a device is powered-off and then powered-on between calls to CheckForDevices. There can be up to 100 devices.

Table 4-5. CheckForDevices

DECLARATION	
INT32 CheckForDevices(LPDWORD devicesConnected, LPDWORD numberOfDevicesConnected, LPDWORD devicesAdded, LPDWORD numberOfDevicesAdded, LPDWORD devicesRemoved, LPDWORD numberOfDevicesRemoved)	
PARAMETER DESCRIPTION	
return value	Error code, or 0 for no error
output: devicesConnected	Array of handles to all USB HOPS Power Supplies connected to the PC.
output: numberOfDevicesConnected	Number of USB HOPS Power Supplies connected to the PC
output: devicesAdded	Array of USB HOPS Power Supplies added since previous call to CheckForDevices
output: numberOfDevicesAdded	Number of USB HOPS Power Supplies added since previous call to CheckForDevices
output: devicesRemoved	Array of USB HOPS Power Supplies removed since previous call to CheckForDevices

Table 4-5. CheckForDevices (Continued)

DECLARATION	
INT32 CheckForDevices(LPDWORD devicesConnected, LPDWORD numberOfDevicesConnected, LPDWORD devicesAdded, LPDWORD numberOfDevicesAdded, LPDWORD devicesRemoved, LPDWORD numberOfDevicesRemoved)	
PARAMETER DESCRIPTION	
output: numberOfDevicesRemoved	Number of USB HOPS Power Supplies removed since previous call to CheckForDevices
EXECUTION TIME	
Rough estimates: 700ms per device added since last call plus 200ms per device connected.	

InitializeHandle

This function initializes the USB HOPS Power Supply

Table 4-6. InitializeHandle

DECLARATION	
INT32 InitializeHandle(DWORD handle, LPSTR headType)	
PARAMETER DESCRIPTION	
return value	Error code, or 0 for no error
input: handle	Handle obtained from CheckForDevices
output: headType	For example, “G532”
EXECUTION TIME	
Rough estimates: Typical hundreds of ms. Maximum 5s	

SendCommand

This function provides a single entry point for executing commands on any Coherent HOPS Power Supply. Command and response strings are up to 100 characters.

Table 4-7. SendCommand

DECLARATION	
INT32 SendCommand(DWORD handle, LPSTR command, LPSTR response);	
PARAMETER DESCRIPTION	
return value	Error code, or 0 for no error
input: handle	Handle obtained from CheckForDevices
input command	Command string
output response	Response string. Always terminated with carriage return-line feed.
EXECUTION TIME	
Rough Estimates: Typical 100 ms. Maximum 5s	

Table 4-8. Command Table

COMMAND	DESCRIPTION	UNITS
KEY		
COMMAND APPLIES TO ALL MODELS		
COMMAND APPLIES TO HIGH CURRENT OEM AND BENCHTOP ONLY		
COMMAND APPLIES TO OEM MODELS ONLY		
?TMAIN	Measured main TEC temperature	ºC
?TSHG	Measured SHG heater temperature	ºC
?TBRF	Measured BRF heater temperature	ºC
?TETA	Measured Etalon heater temperature	ºC
?TMAINCMD	Main TEC temperature command	ºC
?TSHGCMD	SHG heater temperature command	ºC
?TBRFCMD	BRF heater temperature command	ºC
?TETACMD	Etalon heater temperature command	ºC
?MAIND	Main TEC drive	V
?SHGD	SHG heater drive	V
?BRFD	BRF heater drive	V
?ETAD	Etalon heater drive	V
?P	Output power measured and computed from photodiode	W
?PCMD PCMD=	Output power setpoint	W
?PMEM PMEM=	Nonvolatile power setting. This command changes the start-up power setting, but does not change the power immediately.	W
?C	Measured LDD current	A
?CLIM	Maximum LDD current limit	A
?FF	16-bit fault code	hex
?HID	Head serial number	string
?HBDREV	Head board rev	string
?HTYPE	Head type	string
?L	LDD enable state: 0=disabled, 1=enabled	0 or 1

Table 4-8. Command Table (Continued)

COMMAND	DESCRIPTION	UNITS
KEY		
COMMAND APPLIES TO ALL MODELS		
COMMAND APPLIES TO HIGH CURRENT OEM AND BENCHTOP ONLY		
COMMAND APPLIES TO OEM MODELS ONLY		
?KSWCMD KSWCMD=	Key switch command: 0=off, 1=on	0 or 1
?KSW	Key switch actual: 0=off, 1=on	0 or 1
?INT	Interlock status: 0=not OK, 1=OK	0 or 1
?HH	Head hours	hrs
?CMODECMD CMODECMD=	Photo or current mode command: 1=current mode, 0=photomode[a]	0 or 1
?CMODE	Photo or current mode actual: 1=current mode, 0=photomode	0 or 1
?ANACMD ANACMD=	Analog input enable command: 0=disabled, 1=enabled	0 or 1
?ANA	Analog input actual: 0=disabled, 1=enabled	0 or 1
?PSDIO	Power supply digital input/output	hex
?PSGLUEIN	Power supply glue input	hex
?PSGLUEOUT	Power supply glue output	hex
?HEADDIO	Head digital input/output	hex
?REM REM=	Enable remote control: 0=disabled, 1=enabled	0 or 1

a. The key switch must be in the OFF position before switching between Photo Mode and Current Mode.

Table 4-9. DLL Error Code Table

ERROR CODE	DESCRIPTION
0	No error
- 1	Invalid handle
- 2	Invalid head
- 3	Invalid command
- 4	Invalid data
- 5	I2C error
- 6	USB error
- 100	CohrFTCI2C.DLL file not found
- 101	CohrFTCI2C.DLL function not found
- 999	Other error or unexpected error

Table 4-10. Binary Fault Code Table

BIT	DESCRIPTION
0001h	Not used
0002h	Not used
0004h	Not used
0008h	Main TEC error
0010h	LBO or BRF temperature not OK
0020h	Interlock fault
0040h	Not used
0080h	Not used
0100h	Shutter error
0200h	Glue board error
0400h	Not used
0800h	LDD at current limit
1000h	Not used
2000h	Not used
4000h	Not used
8000h	Not used

Shutting Down the Laser

In the case of an emergency, the laser maybe disabled at any time by turning off the physical keyswitch without harming the laser.

SECTION FIVE: MAINTENANCE AND SERVICE

DANGER!
Do not open the Genesis™ MX subsystem. There are no user-serviceable components or adjustments inside. There are hazardous levels of laser energy inside the laser head.

Table 5-1. Troubleshooting (Symptoms)

	PHYSICAL SYMPTOM	LED'S	SOFTWARE SYMPTOM
1	Does not turn on	All OFF	Invisible to PC
2	Momentary AC off	Depends on key	Error: I2C error
3	Does not turn on	Red ON Yellow OFF	Error: Invalid head
4	Green LED does not turn on with key	Yellow ON	Keyswitch stays off, or jumps back to off
5	Laser off	Red ON Yellow OFF Head ON	All normal (no red LEDs ON, Xtal Temp OK LEDs on, yellow LDD at limit on)
6	Laser off	Normal	Current stays at zero, otherwise normal
7	Laser off	All ON	All normal
8	Laser off	Red ON Yellow OFF	ON Status LEDs Main TEC error Main TEC Fan ON
9	Power is low	Normal	Current rails, yellow LDD at Limit LED on with key on
10	Normal	Normal	Error: Invalid head
11	Normal	Normal	Error: I2C error
12	Bad power calibration (reads higher)	Normal	All normal
13	Bad power calibration (read lower)	Normal	All normal
14	Laser off	Red ON Yellow OFF	OFF Status LED BRF Temp OK or SHG Temp OK

Table 5-2. Troubleshooting (Cause/ Solution)

	POSSIBLE CAUSE/SOLUTION	FURTHER STEPS
1	No AC power, fuses missing or open	Check the AC connection and fuses
2	Defective fuse holders.Can be triggered by operation in hot ambient	
3	Head control cable unplugged	Make sure the AC power is OFF and then plug the control cable is in.
4	The enable loop is open, check the software key and the external enable jumper.	If not using the Coherent supplied Interlock plug, verify that it works with the supplied plug and then consult manual for information regarding the enable interface.
5	Main interlock chain open: check the connection of all external interlock or interlock jumpers	If not using the Coherent supplied Interlock plug, verify that it works with the supplied plug and then consult manual for information regarding the Interlock interface.
6	Head power cable unplugged, or not fully inserted	Make sure the keyswitch is OFF and then plug the power cable all the way in
7	This condition indicates a problem triggered the interlock while the laser was on, and has since solved itself. If the laser was unattended, clear the fault by switching the key off. Now you can key on and try to observe the problem	If there is no apparent reason, a glitch is triggering the interlock, it can be electronic noise getting in the system.
8	System overheated: If it has a fan it will be on at maximum speed. Interlock condition will remain until head temperature goes below 35 C.	Check for and resolve root cause: Excessive ambient temperature, fan disconnected or defective, chiller off, defective TEC or TEC driver, if the problem appears internal, please contact Coherent Technical Support
9	Laser head has degraded, temperature setpoints changed from original factory settings, system running hot, but not enough to trigger fault	Contact Coherent Technical Support.
10	Memory values corrupted, head communication damaged	Contact Coherent Technical Support.
11	USB cable disconnected, driver error, or AC power lost.	Clear the error message and unplug and re-plug USB cable
12	Coarse photocell calibration jumper removed, memory values corrupted	Contact Coherent Technical Support.
13	Memory values corrupted	Contact Coherent Technical Support.
14	Crystal(s) not at temperature.	This is normal for a few minutes after AC power on, if the condition remains it indicates a problem in the laser head

APPENDIX A. PARTS LIST AND ACCESSORIES

Parts List

Table A-1. Parts List

PART NUMBER	ITEM DESCRIPTION
1110487	**100 - 120 V:** 8.0 A 250 V Time Lag Fuse (T8AH, 250V)
1157849	**220 - 240 V:** 4.0 A 250 V Time Lag Fuse (T4AH, 250V)
1112790	Chiller Thermotek, 0P9T255P3C-R, RoHS Compliant
1172237	Tubing Kit[a]
1168012	RS232 DB9-RJ45 Adapter
1106348	AC Power Supply Cord, 10A, 250VAC, H05VVF3G1.00mm^2, 3m length, PVC Jacket
1175875	AC Power Supply Cord, North American, 10A, 125VAC, NEMA 5-15P plug, C13 connector, 18AWG x 3, 3.05m length, Black, UL/CSA

a. If ordered with water cooled riser and Thermotek chiller.

For model specific parts, contact your local service representative.

Accessories

Power Meters and Sensors

Coherent offers a variety of instruments for laser test and measurement. For additional detailed information, including product selection guides, please visit our web site at **www.Coherent.com**.

For the most common diagnostics, Coherent recommends the FieldMax-Top™ power meter with a PM10 power sensor to measure the output of the Genesis™ MX. The PM10 is ideal for the entireGenesis™ MX family.

Recommendations

Below is a great product combination covering the 0.19 µm to 11 µm wavelength range for all Genesis™ MX power levels. The power meter is a versatile, easy to use digital meter designed for field service and production applications. The power sensors are air-cooled, surface absorbing and intended for low to medium Pulsed and CW powers.

FieldMaxII-Top™ Power Meter	PM10 Power Sensor
Part Number 1098580	Part Number 1097901

Figure A-1. Recommended Power Meter and Power Sensor

APPENDIX B. GENESIS SLM WARM-UP AND ETALON CAPTURE

1. Follow the procedures in the manual for connecting the laser to the power supply and installing the OPSL software.
2. Turn on the power supply with the key switch off.
3. Wait 5 minutes to allow the TEC drive voltage to stabilize.
4. Turn the key switch on.
5. Command the power to operating power using the "Set Power" cell on the OPSL software panel.

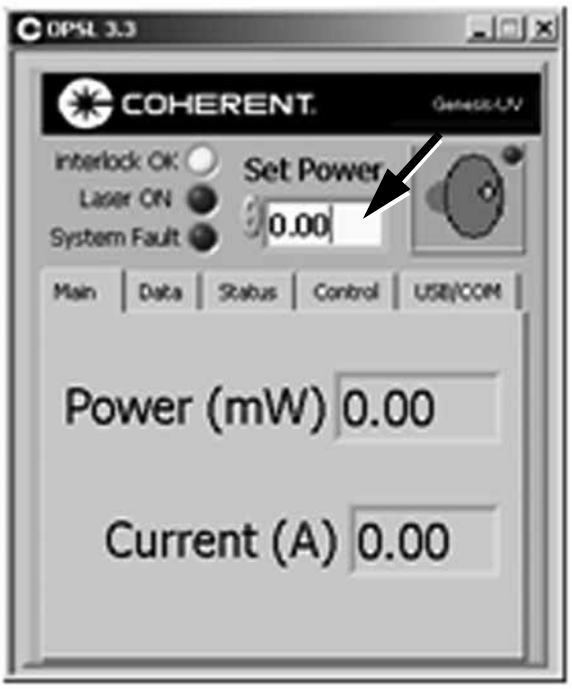


Figure B-1. "Set Power" Cell

6. Wait 5 minutes to allow the TEC drive voltage to stabilize at the set power. The TEC drive voltage is reported in the "Data" panel of the OPSL software in the "Main, Drive" cell.
7. The current will increase as the laser warms up at the set power. The power and current are reported in the "Main" panel of the OPSL software.

8. Execute an etalon capture by clicking the "Etalon Capture" button located in the "Control" panel of the OPSL software.

Figure B-2. Etalon Capture

9. After a successful etalon capture, the laser will be running single frequency and the current will decrease.

10. The etalon capture may have to be repeated after changes to the power set point or excursions in ambient temperature.

WARRANTY

Coherent, Inc. warrants the Genesis™ MX series 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.

Laser systems are warranted to conform to Coherent's published specifications and to be free from defects in materials and workmanship for a period of 1-year or 5000 hours, whichever comes first.

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
µm	Micron
µrad	Microradian(s)
µsec	Microsecond(s)
$1/e^2$	Beam diameter parameter
A	Amperes
AC	Alternating current
Amp(s)	Amperes
BRF	Birefringent filter
CDRH	Center for Devices and Radiological Health
CFR	Code of Federal Regulation
cm	Centimeter(s)
DC	Direct current
DLL	Dynamic-link library
EEPROM	Electrically erasable programmable read only memory
EMC	Electromagnetic Compliance
FAP-I™	Fiber array package-integrated
FSR	Free spectral range
GUI	Graphical User Interface
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)
MPE	Maximum Permissible Exposure
mrad	Milliradian(s)
ms	Millisecond(s)
mV	Millivolt(s)
mW	Milliwatt(s)
Nd:YAG	Neodymium:Yttrium Aluminum Garnet
nm	Nanometer(s)
NOHD	Nominal Optical Hazard Distance
OPSL	Optically Pumped Semiconductor Laser
RMS	Root mean square
TEC	Thermo-electric cooler
TEM	Transverse Electromagnetic Mode (cross-sectional laser beam mode)
VAC	Volts, alternating current
VDC	Volts, direct current
W	Watt(s)

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