*Operator's Manual*
*Genesis™ MX Series OEM Laser*

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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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.

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## Preface

This manual contains user information for the Genesis™ MX Series. The Genesis™ MX Seriesis an OEM product designed for incorporation into other equipment. Accordingly, the device has not been certified by CDRH and is to be used only as a component. The user is responsible for CDRH certification and/or other regulatory compliance in the location of use.

**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.**

**Performance of procedures other than those specified in this manual may result in hazardous laser radiation exposure.**

## 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.

## *Symbols Used in This Manual*

**This symbol is intended to alert the operator to the danger of exposure to hazardous visible or infrared (visible) laser radiation.**

**This symbol is intended to emphasize the presence of important operating instructions.**

**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.**

# SECTION ONE: LASER SAFETY

## *Laser Safety*

Genesis™ MX Series lasers emit Class IV radiation. Extreme care must be exercised during operation. Only persons familiar with the safety precautions and practices in this manual should operate laser products.

Directly viewing the laser beam or exposure to specular reflections must be avoided. Serious injury may result if any part of the body is exposed to the beam. Proper eye-wear must be worn at all times.

**DANGER!**
**Avoid eye or skin exposure to direct or scattered radiation. A Genesis™ MX Series is a Class IV laser product. Always wear proper eye protection when operating.**

**DANGER!**
**Average powers of up to 80 W per device could be accessible. Take the appropriate electrical precautions to avoid injury.**

Personnel operating these laser products should be familiar with and follow the recommendations given below and in this manual:

1. Always wear laser safety eye-wear which is optically dense at the wavelength of operation.
2. Never look directly into the beam or at specular reflections even while wearing protective eye wear.
3. Use safety interlocks to restrict access to laser areas and prevent unauthorized use of the lasers.
4. Post warning signs for Class IV laser products.

## *Optical Safety*

Because of its special properties, laser light poses safety hazards not associated with light from conventional sources. The safe use of lasers requires that all laser users, and everyone else near the laser system, are aware of the dangers involved. The safe use of the laser

depends upon the user becoming familiar with the instrument and the properties of intense and coherent beams of light.

**DANGER!**
**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, the user is advised to follow the precautions below.

1. Observe all safety precautions in the operator's manual.
2. Exercise extreme caution 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.

**DANGER!**
**Wear laser safety glasses to protect against the radiation generated from the laser. It is assumed that the operator has read this section and is familiar with laser safety practices and the dangers involved. Ensure all personnel in the area are wearing laser safety glasses.**

6. As a precaution against accidental exposure to the output beam or its reflection, those using the system should wear the appropriate laser safety glasses as designated by the wavelength being generated.

**DANGER!**
**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.**

**Performance of procedures other than those specified in the manual may result in hazardous radiation exposure.**

7. Use the laser in an enclosed room. Laser light will remain 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 all laser users and everyone else near the laser system of the hazards specific to the class of laser present.
9. Advise everyone using the laser of these precautions. It is good practice to operate the laser in a room with controlled and restricted access.

## *CDRH and Regulatory Compliance*

The Genesis™ MX Series 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 location of use.

## *Safety Labels*

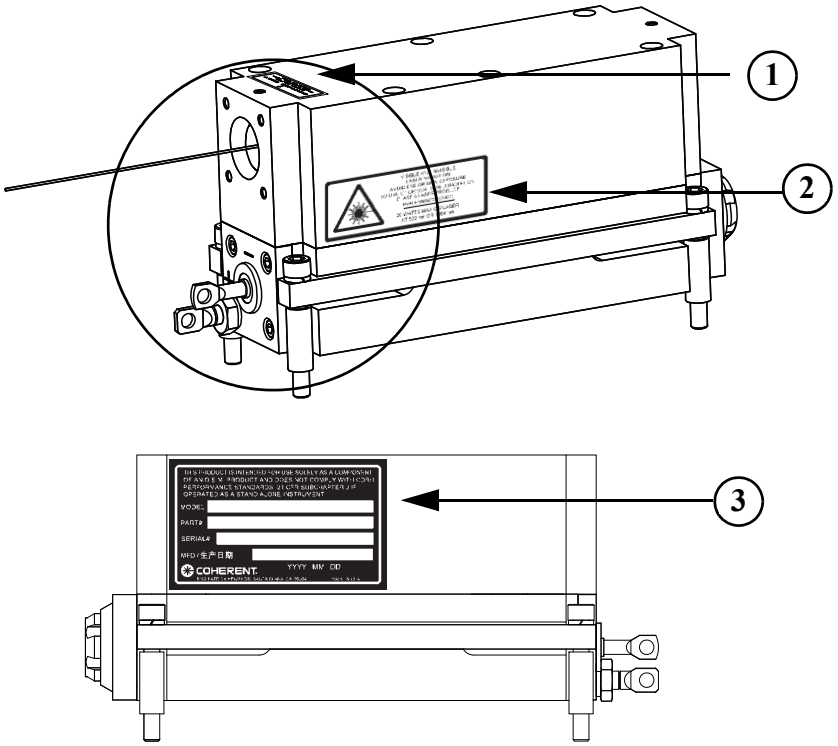
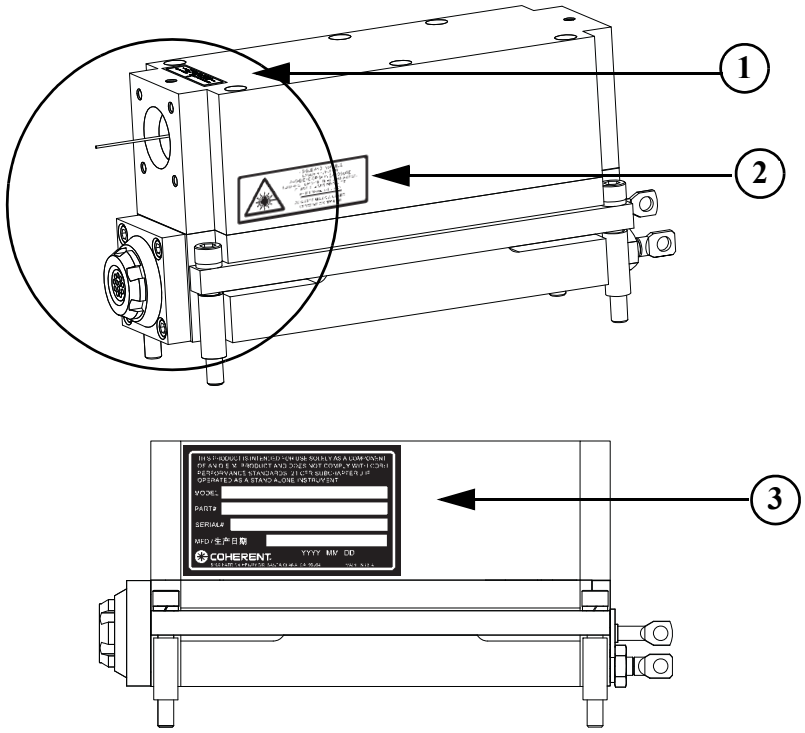


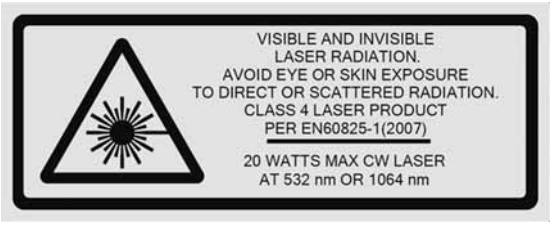
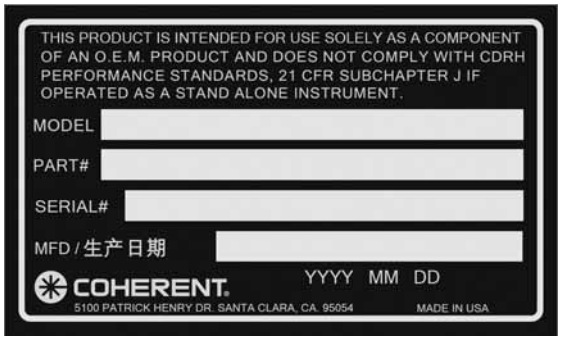

***Figure 1-1. Location of Labels for Genesis MX***




Note that the output end is opposite of the visible head.

***Figure 1-2. Location of Labels for Genesis MX IR***

***Table 1-1. Description of Labels***

| | LABEL | DESCRIPTION |
|---|---|---|
| **1** |  | This label is placed at the emission end of the laser head to warn operators of exposure to the laser beam, |
| **2** |  | This label, placed on the side of the laser displays the maximum output and wave-length(s) of the laser. |
| **3** |  | This label, placed on the side of the laser opposite form label 2, displays the laser model number, part number, serial number and the manufacture date. |

# SECTION TWO: DESCRIPTION AND SPECIFICATIONS

## *Description*

The Genesis™ MX Series is a small and robust multi-Watt visible and invisible laser based on Coherent's patented Optically Pumped Semiconductor Laser (OPSL) technology.


***Figure 2-1. Genesis™ MX Series***

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 overlaying dielectric layers that act as a rear surface total reflector is less

than 10 microns. The bottom surface, in turn 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 wavelength by frequency doubling with non-linear crystals.

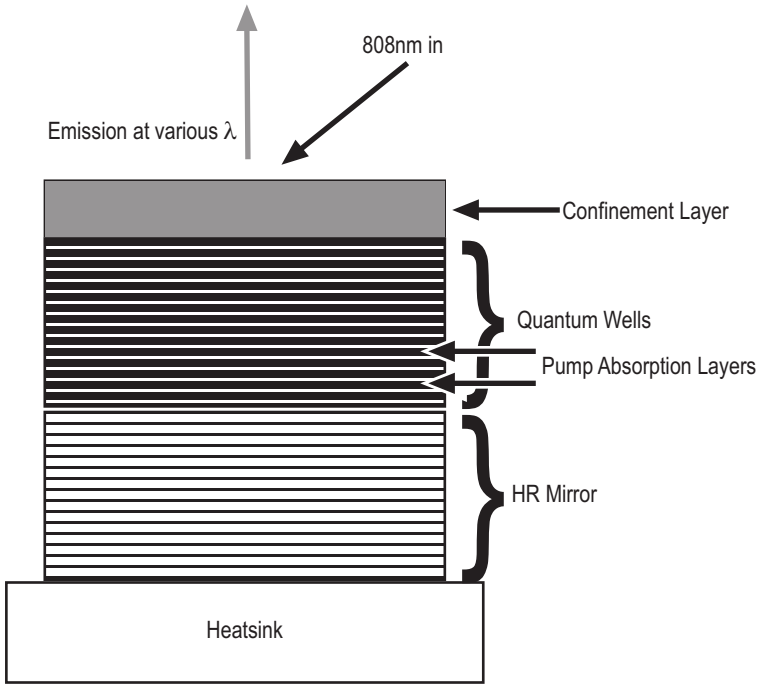



***Figure 2-2. OPSL Diagram***

The Genesis™ MX Series is available as single (STM) or multi-transverse mode (MTM).

MTM OEM is the high current version of the Genesis™ MX Series. The MTM OEM 'system' is made of the OEM head, headboard and cables kit (specific to MTM only), with available high -current OEM power supply (low-profile, no front panel interface or a high -current benchtop power supply).

STM OEM is the low current version of the Genesis MX.The STM OEM 'system' is made of the OEM head, low current controller (controls temperature servos and light loop/photocell), and an optional 24VDC (or AC input) power supply. The STM low current benchtop power supply has a front panel interface and a built-in controller.

The Genesis™ MX Series may be ordered with one or more of the following optional features.

***Table 2-1. Genesis™ MX Series Options***

| OPTION | P/N | COMES PRE - ASSEMBLED TO LASER HEAD? | FIELD INSTALLABLE |
|---|---|---|---|
| Manual Shutter | 115119 | Yes | Yes[a] |
| Electrical Shutter | 1147393 | Yes | Yes[ab] |
| Collimator | 1141887 | Yes | No |
| Fiber Port<br>SMA<br>FC | 1165511 | Yes | No |
| Air Riser MTM<br>(TEC included) | 1165502 | Yes | No |
| Air Riser STM<br>(TEC included) | 1166584 | Yes | No |
| Water Riser<br>(TEC included) | 1165494 | Yes | No |
| Head Mounting Kit<br>(TEC not included) | 1165499 | Yes | Yes |
| Headboard Assy Kit[c] | 1165701 | No | No[d] |
| High Current OEM Power Supply | 1149769 | No | Yes |
| MTM High Current Benchtop Power Supply | 1176739 | No | Yes |
| Low Current STM Controller | 1176739 | No | Yes |
| STM Low Current Controller<br>STM Optional AC/DC Power Supply | 1183641<br>117035 | No<br>No | Yes<br>Yes |

a. Installable/ replaceable if no collimator or fiber port is attached,
b. External voltage needs to be provided when using Low Current STM Power Supply
c. The headboard assembly kit must be purchased in conjunction with the MTM head and the Coherent High Current OEM/ Benchtop Power Supply. Does not apply to STM.
d. The headboard is specifically calibrated to match each head. Calibration must be performed at the factory for the laser to be functional.

## Utility Requirements

Before installing the system, confirm the availability of the following utility requirements.

***Table 2-2. Utility Requirements, Dimensions and Weights***

| PARAMETER | VALUE | |
|---|---|---|
| | High Current (MTM) | Low Current (STM)[a] |
| **ELECTRICAL** | | |
| Operating Voltage | 100 – 240$V_{AC}$ | 24V±10%$V_{DC}$ |
| Frequency (Hz) | 50 to 60 | |
| Power Consumption (W) | 300~600 | 250~300 |
| Maximum Current | 8A @ 120V<br>4A @ 220V | 10A |
| CE Mark[b]<br>High Current OEM Power Supply<br>Benchtop Power Supply | EN 55011<br>EN 61326<br>EN 60825<br>EN 61010 | |
| Low Current STM Power Supply | EN 55011<br>EN 61326<br>EN 60825[c]<br>EN 61010 | |
| **DIMENSIONS** | | |
| Laser Head[d] (L x W x H) | 121 x 44 x 65 mm (4.76 x 1.73 x 2.54 in) | |
| Power Supply (L x W x H)<br>High Current OEM Power Supply | 290 x 210 x 90 mm (11.42 x 8.27 x3.54 in.) | |
| Benchtop Power Supply | 361 x 229 x 160 mm (14.22 x 9.01 x 6.29 in.) | |
| Low Current Controller | 270 x 127 x 78 mm (10.63 x 5 x 3.07 in.)[e] | |
| Cables (laser head to controller)[f] | 3.05 m/1.83 m (10 ft./6 ft.) | 1.83 m (6 ft.) |

a.Requires user supplied 24$V_{DC}$ external power supply. COSEL PBA300F-24 recommended. See http://www.cosel.co.jp/en/products/pdf/SFE_PBA300-1500.pdf for requirements.
b.The laser head is not CE certified.
c.Not all OEM systmes are fully EN 60825 compliant.
d. Back connector not included in laser head length dimension.
e. Dimension given for controller only. For dimensions for the external power supply see http://www.cosel.co.jp/en/products/pdf/SFE_PBA300-1500.pdf under the 300F Series
f.Standard lengths. Cable lengths depend on maximum current.

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

| PARAMETER | VALUE | |
|---|---|---|
| | High Current (MTM) | Low Current (STM)[a] |
| **WEIGHTS** | | |
| High Current OEM Power Supply | 3.63 Kg (8 Lbs.) | |
| Benchtop Power Supply | 5.9 Kg (13 Lbs.) | |
| Low Current Controller | 1.6 kg (3.6 lbs.) | |
| Laser Head | 0.730 Kg (1.61 ± 0.02 Lbs.) | |
| **ENVIRONMENTAL SPECIFICATIONS** | | |
| Ambient Temperature:<br>Operating<br>Non-Operating | <br>10 to 40 °C (50 to 104 °F)<br>-10 to 60 °C (5 to 140 °F) | |
| Cooling water (if chiller is not used)[g,h]: | 10 to 35 °C (10-95° F)<br>Water flow > 1L/min. (0.26 gal./min.) | |
| Relative humidity non condensing: | 5 to 95 %[i] | |
| Altitude | sea level to3048 m (10000 ft.) | |

g. Warm-up time must be extended to include the stabilization time of the cooling circuit
h.Rapid variations of coolant temperature may affect noise and pointing performance
i.Non-condensing.

***NOTICE!***
**Never use DI water for cooling.**

## Wavelength

The wavelength is determined by the OPS chip and internal BRF. For best performance, set the temperature to the factory recommended value.

## Output Window

Laser radiation is emitted through the output window. There is a set of threaded mounting holes, symmetrically located on the output face for mounting user-supplied accessories.

## *Specifications*

Refer to the device data sheets or web site for the specifications for your particular Genesis™ MX Series model. Visit http://www.coherent.com.

# SECTION THREE: INSTALLATION AND INTEGRATION

## *Introduction*

This section covers the receiving and installation procedure of the Genesis MX Series head.

Sections "Receiving and Inspection" on page 3-1 and "Handling" on page 3-3 applies to installation whether it is performed with Original Equipment Manufacturer (OEM) supplied or Coherent accessories.

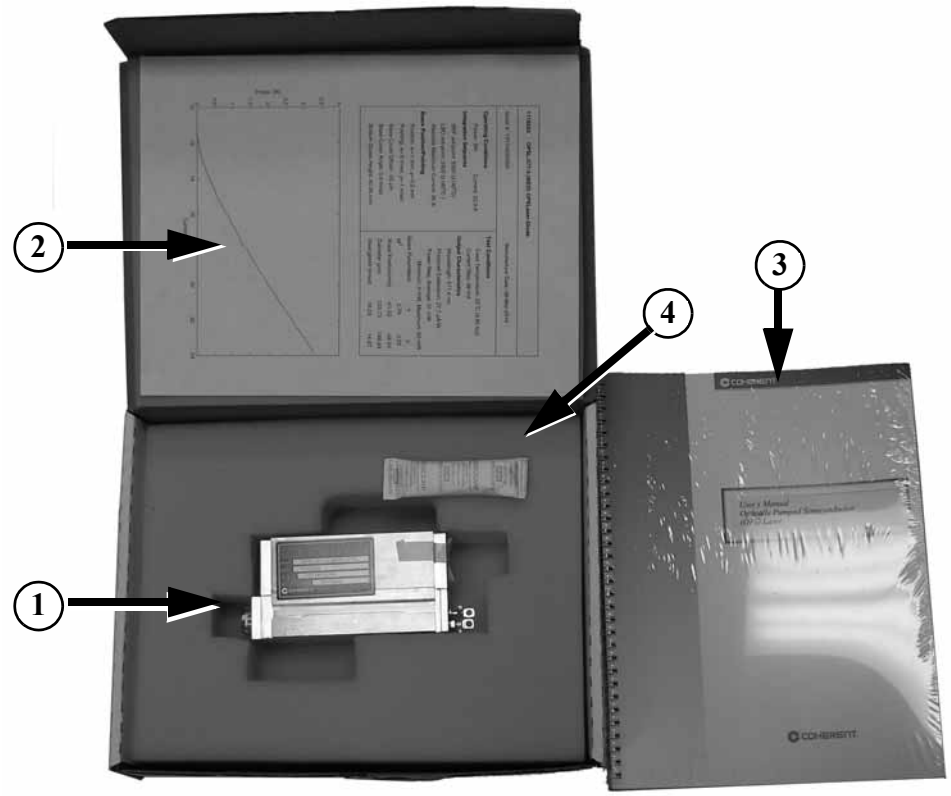
OEMs who choose to design their own heat sinking, power supply, and control electronics, thermal and electrical requirements should refer to section "OEM Installation Guidelines" on page 3-4.

For installation with Coherent supplied accessories, refer to "Installation with Coherent Supplied Accessories" on page 3-16.

## *Receiving and Inspection*

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

***NOTICE!***
**Save the original shipping box. Should the unit ever need repair, it must be returned in its original shipping box; otherwise, the warranty may be voided.**




1. Laser Head
2. Data Sheet
3. Manual
4. Desiccant

***Figure 3-1. Packed Genesis MX Series[a]***

a. Head shown without plastic wrapper.

## Handling

The Genesis MX Series is shipped in an anti-static package. This packaging is recommended for long-term device storage.

***NOTICE!***
**The Genesis MX Series can be damaged by electrostatic discharge (ESD). Use proper grounding procedures when handling unit, such as a personal grounding strap.**

The Genesis MX Series has a shorting clip connecting the anode and cathode electrical leads to avoid inadvertent electrostatic discharge damage. Leave this protective device in place when handling the unit.

A protective cap covers the optical emission area protecting it from dust and environmental contaminates. Avoid contact with the output window. Leave the protective cap in place when handling the unit.

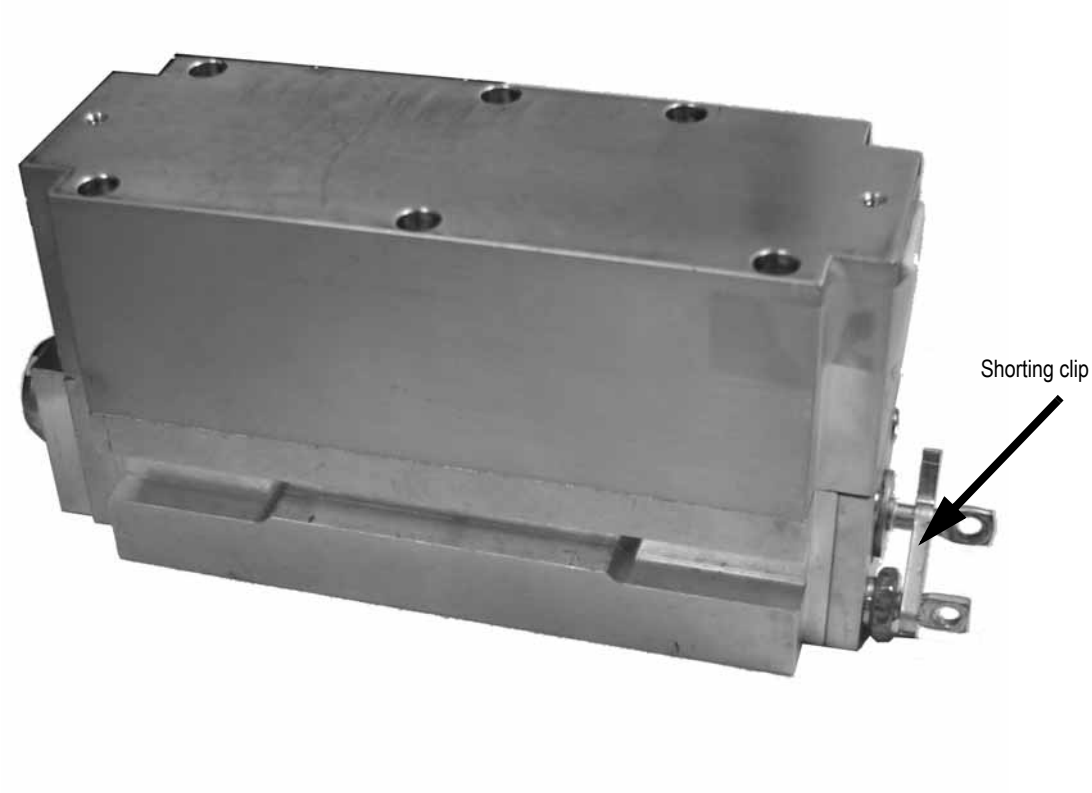



***Figure 3-2. Head with Clip and Window Cover***

## OEM Installation Guidelines

Installation procedures differ depending on each OEM, therefore the accessories and parts required for installation are outlined in Table 3-1. Electrical specifications for components internal and external to the laser head are listed in Table 3-3 and Table 3-6 respectively. A general instruction on installing the heat sink follows. See "Appendix C: Cooling Requirements (for use with non-Coherent heatsinks)" on page C- 1 for heat sink design guidelines.

***Table 3-1. Accessories and Parts Required for Electrical Installation***

| PART DESCRIPTION | PURPOSE |
|---|---|
| Air-cooled or water-cooled heat sink capable of removing Genesis MX Series dissipated power; refer to Table 3-5 for requirements | Removes waste heat from the Genesis MX Series base. |
| TECs | Stabilizes temperature of diode/baseplate |
| One high power temperature control circuit | Keeps the laser at safe operating temperature (included with Coherent Power Supply/COntroller) |
| Four 8-32 or M3 screws (Used with clamping bars)[a] | Secures the Genesis MX Series base to the heat sink. |
| Thermal Grease | Ensures good thermal contact between the Genesis MX Series base and the heat sink. |
| Hook-up wire 8 gauge for operating current 40 amps<br>Hook up wire 6 gauge for operating current 50 amps | Connects the Genesis MX Series to power supply. |
| Power supply/ controller | Provides electrical power and control for the Genesis MX Series. Refer to the paragraph titled, "Diode Driver Requirements" on page 3-12. |
| Diode Driver | Generates the current necessary for the Genesis MX operation (included with Coherent Power Supply/Controller) |
| Insulated #6 ring tongue connector | Secures electrical connections to the Genesis MX Series. |
| Beam stop | Blocking Genesis MX Series emissions. |
| Protection diode (1N5817 recommended)<br>(Note that the use of a recommended power supply eliminates the necessity of a protection diode) | When using a general laboratory power supply, it protects the Genesis MX Series from reverse electrical biases that would destroy the device. Refer to the paragraph titled, Electrical Installation, and to Appendix A for additional information (supplied with unit). |
| Two low power temperature controllers | For accurate control of the temperature of the BRF and SHG (included with Coherent Power Supply Controller). |
| Power meter: See Coherent catalog or contact your sales representative for a full line or optical power meters. | Calibration of the monitor photodiode. |

***Table 3-1. Accessories and Parts Required for Electrical Installation (Continued)***

| PART DESCRIPTION | PURPOSE |
|---|---|
| Connector WW Fischer part # S-1031-A012-### or equivalent<br>http://www.fischerconnectors.com/pdf/General-Catalogue.pdf | Electrical connection to the internal components. |
| Clamping bars(2) | To uniformly clamp laser to TEC's to the heat sink. |
| Insulated #6 ring tongue connector | Secures electrical connections to the Genesis MX Series. |

a. Both the 8-32 and M3 will fit through the spacers provided in the clamping kit. However, for Coherent risers, use 8-32.The screw length is determined by the tap depth in the heat sink riser.

## Simplified Block Diagram

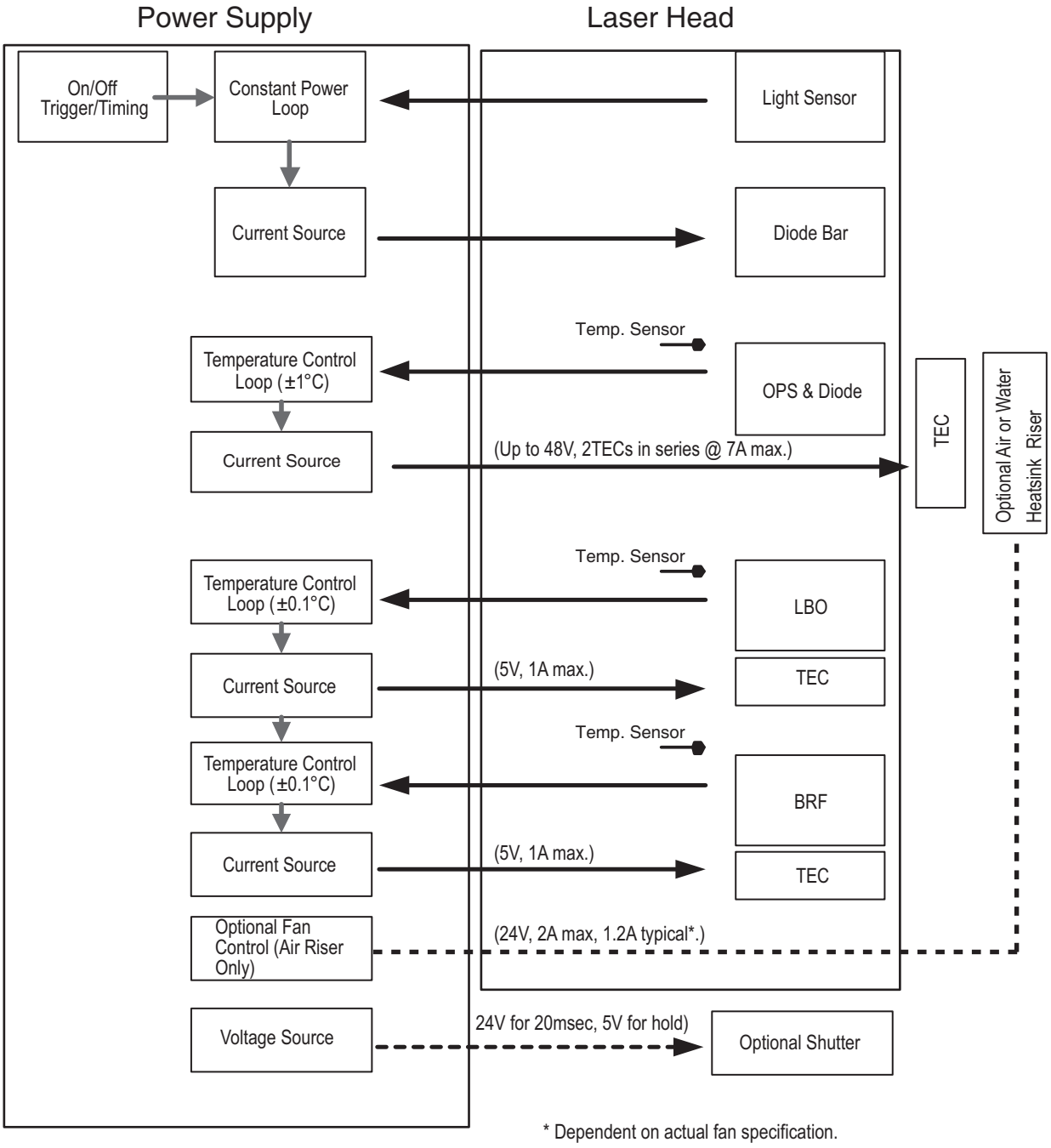



***Figure 3-3. Genesis MX Series Simplified Block Diagram with OEM Supplied Power Supply***

## Rear Panel Connections

The rear panel of the Genesis MX Series has a Fischer™ connector serving as the interface to the internal components.

***Figure 3-4. Genesis MX Series Rear View (Fischer-Connector)***

The following table lists internal components of the laser that can be accessed through the Fischer™ connector.

***Table 3-2. Pin Assignments***

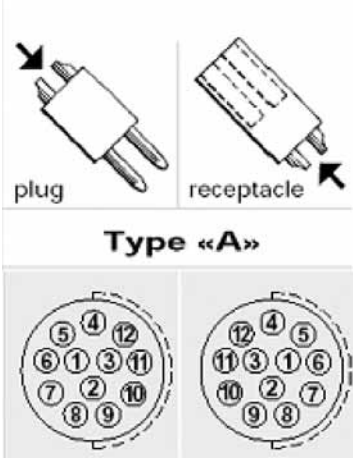
| | | |
|---|---|---|
|  | PIN 1<br>PIN 2<br>PIN 3<br>PIN 4<br>PIN 5<br>PIN 6<br>PIN 7<br>PIN 8<br>PIN 9<br>PIN 10<br>PIN 11<br>PIN 12 | Thermistor Common (BRF & LBO)<br>LBO Thermistor<br>Reserved<br>Case Thermistor<br>Case Thermistor<br>Photocell Cathode<br>Photocell Anode<br>BRF Thermistor<br>BRF TEC +<br>BRF TEC -<br>LBO TEC +<br>LBO TEC - |

***Table 3-3. Head Internal Component Specifications***

| COMPONENT NAME | COMPONENT DESCRIPTION | |
|---|---|---|
| **The specifications are listed as a guide for installation.** | | |
| | **PARAMETER** | **VALUE** |
| PHOTOCELL | Manufacturer | OSI Optoelectronics |
| | Part Number | PIN-5DPI |
| | Photo Current Value | See traveler shipped with head. |
| | The photocells used inside the lasers are planer infused silicon diode featuring high sensitivity and moderate speeds. It is not recommended to reverse bias these photodiodes to increase speed as damage may result with more than 3V of reverse bias. They are provided for use in light loop regulation and noise reduction circuits. See URL below for data sheet info: http://www.osioptoelectronics.com/ | |
| PUMP DIODE | Io (A) | < 48 |
| | Vo (V) | < 2 |
| | Manufacturer | Coherent |
| | Part Number | 1055135 |
| | The Pump diode is a Coherent 40 W 810 nm CCP addressed externally to the OPSL laser through terminals. The anode terminal is connected to the laser case. For more information on the electrical characteristics of the diode see: http://www.coherent.com/ | |
| NTC THERMISTORS | Manufacturer | Vishay/Dale |
| | Part Number | 01T1002JF |
| | All of the thermistors used in the Genesis MX Series laser are conformal coated, negative temperature coefficient (NTC) style with a typical resistance of 10K ohms at 25ºCelsius. using 30 AWG solid nickel wire and Teflon insulation. See data sheet for further details: http://www.vishay.com/ They are provided for temperature monitor and regulation of the TECs | |
| SMALL TEC MODULES | These TECs are used for BRF and SHG temperature regulation. They are small as the thermal load of the BRF and SHG assemblies is negligible. http://www.marlow.com | |
| | Manufacturer | Marlow Industries |
| | Part Number | MI1025T |
| | Vmax @ 27ºC (V) | 4.40 |

## OEM Heat Sink Installation Guideline

If the Genesis MX Series is ordered with a heat sink, it will come pre-assembled to the unit. See Table 3-4 for electrical (air cooled fan power) or water flow (water cooled) requirements.

***Table 3-4. Coherent Heat Sink Utility Requirements***

| AIR COOLED HEAT SINK (FAN POWER) | |
|---|---|
| Io (A) | 2 A max, 1.2 A (typical) |
| Vo (V) | 24 V |
| **WATER COOLED HEAT SINK** | |
| Flow Rate | 1L/ min. |
| Temperature | 20-25ºC |

---

***NOTICE!***
**Failure to provide adequate heat sink will result in the unit shutting down in a matter of minutes with permanent damage.**

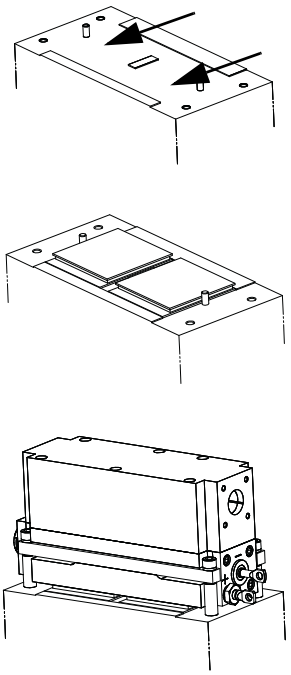
---

When installing the Genesis MX Series with a user supplied heat sink, follow guidelines below.

Two mounting schemes, **air cooled** or a **water cooled heat sink**, with adequate heat capacity along with 2 TEC's in series in a closed loop system are recommended. Refer to Appendix C: Cooling Requirements (for use with non-Coherent heatsinks) for guidelines dimensioning the heatsink.

The heat sink mounting surface must be very flat (to within 0.001 mm over the entire mounting surface) to ensure good thermal contact.

Figure 3-5 provides general instructions for installing a heat sink to the laser head, shown with a Coherent heat sink. For specific dimensions, including those of the clamping bars, see Figure 3-27 through Figure 3-30 .



1. Apply a thin, even layer of thermal compound to the surface of the heat sink and laser head that will make contact with the TECs.

2. Place TECs in series on top of the thermal compound. Ensure that they are laying flat on the surface and even with respect to each other. [a]

3. Place laser head on top of the TECs.[b] Secure laser head to heat sink with clamping bars, spacers and four #8 screws of appropriate length.[c]

a. The area of the heat sink where the TECs are to be mounted must be prepared according to the dimensions in Figure C-1.

b. If required, isolate the laser head using Kapton tape on the clamping bars according to Figure 3-6. Read "Diode Driver Requirements" on page 3-12 for more information regarding electrical isolation of the head.

c. The TECs should be clamped and under compression as recommended by TEC manufacturers so they are not subjected to the sheer stress of supporting the laser head. The length of the spacers determines the amount of pressure exerted on the TECs. A dimensioned drawing for the clamping bars is also given in Figure C-1. NOTE: The length of the spacers in the drawing assume a TEC height of 0.139 in (3.53 mm).

***Figure 3-5. Heat Sink Installation***

***Table 3-5. Head External Component Descriptions***

| COMPONENT NAME | COMPONENT DESCRIPTION | |
|---|---|---|
| LARGE TEC MODULES STM | Two larger TEC modules connected in series are mounted in between the laser and the heat sink. They are used in conjunction with a NTC thermistor to regulate the temperature of the individual laser sources to maintain optimum laser operation.http://www.marlow.com | |
| | Manufacturer | Marlow Industries |
| | Part Number | RC12-8-01L |
| | Imax @ 27ºC(A) | 7.40 |
| | Vmax @ 27ºC (V) | 14.7 |

***Table 3-5. Head External Component Descriptions (Continued)***

| COMPONENT NAME | COMPONENT DESCRIPTION | |
|---|---|---|
| LARGE TEC MODULES MTM[a] | Two larger TEC modules connected in series are mounted in between the laser and the heat sink. They are used in conjunction with a NTC thermistor to regulate the temperature of the individual laser sources to maintain optimum laser operation. http://wwwkryothermusa.com | |
| | Manufacturer | KRYOTHERM |
| | Part Number | DRIFT 1.15-U |
| | Imax @ 27ºC(A) | 7.9 |
| | Vmax @ 27ºC (V) | 24.6 |

a. Parameter given at 300ºK in Kryotherm document

## Diode Driver Requirements

Coherent strongly recommends using a power supply specifically designed to drive laser diodes. Contrary to general purpose laboratory supplies, diode drivers typically have built-in transient protection circuitry and minimize potential damage.

If using a non Coherent power supply, ensure that all the requirements listed in Figure 3-3 and Table 3-6 are met. Table 3-3 lists the internal components accessible through the control connector to aid the user in their design.

***Table 3-6. Diode Driver Requirements***

| PARAMETER | REQUIREMENT |
|---|---|
| Operating Diode Current (A) | <33 |
| Maximum Diode Current (A) | <45 |
| Diode Voltage | 1.5 to 2.2 |
| Cooling Requirements[a] | Active cooling required |
| **Example 3rd Party Diode Driver[b]:**<br>Lumina Power Inc. (http://www.luminapower.com)<br>Model #: LDD-150-50-3 (CW)<br>Model #: LDQCW-50-50-2.5-2mS (Pulsed) | |

a. Contact integration support for air or water-cooling TEC options.
b. If using these models, ensure that Genesis MX Series Laser head is electrically isolated. Failure to do so may damage the device from inadvertent electrical transients. See "Heat Sink Installation" for instructions on isolating the head.

***NOTICE!***
**Use of a poorly regulated supply will destroy the unit.**

Note that the diode anode is electrically connected to the case (positive ground). Depending upon their design, many diode drivers cannot work properly in a positive ground configuration. In such cases the laser must be isolated from ground, by floating the heat sink assembly, or by isolating the laser head from the heat sink. To isolate the laser case, use insulating locator pins (plastic or nylon) and isolate the clamps at the contact points using Kapton tape as shown in Figure 3-6.

***NOTICE!***
**If configuring the laser with a power supply incapable of handling a grounded anode, the head must be electrically isolated (See Figure 3-6). Failure to do so may damage the device from inadvertent electrical transients.**

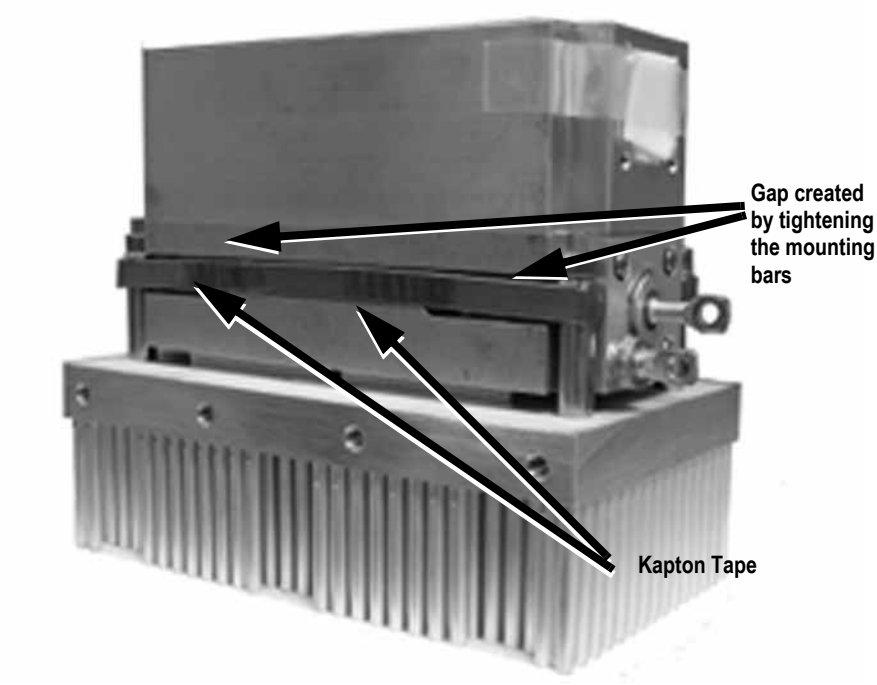



***Figure 3-6. Electrically Isolated Head***

## Front Panel Connections

Electrical connections to the internal pump diode are made using the anode(+/ red) and cathode(-/ black) leads marked in Figure 3-7. Note that the anode lead attached directly to the case is common to the entire package.

The connections to these leads can be made using a #6 insulated ring tongue connector. Use appropriate hook-up wire for the anode and cathode connections as indicated in Table 3-1.

***Figure 3-7. Electrical Connections to the Internal Pump Diode***

## Electrical/ Manual Shutter Installation

The shutter (electro-mechanical or manual) if ordered, will come pre-assembled to the head. If an electro-mechanical shutter was ordered to be used in conjunction with non-Coherent power supply, or the low current STM power supply, a pulsed drive system that starts at 24V and decays to 5V in 150ms must be provided. See Figure 3-8 for pin-out information.

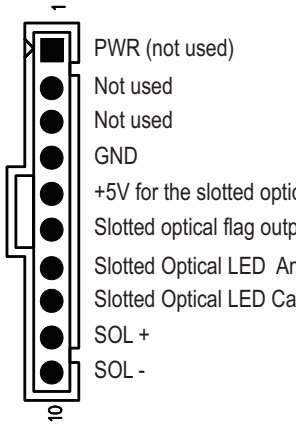



***Figure 3-8. Shutter Cable Pin-out***

***NOTICE!***
**DO NOT attempt to remove/ reinstall shutter should a collimator or a fiber port be already attached to it.**

## *Installation with Coherent Supplied Accessories*

Do not turn the Genesis MX Series on until all installation procedures have been completed.

## *Simplified Interconnect Diagrams*

Coherent offers several types of power supplies for the Genesis MX Series. The high current, or MTM Coherent Power Suppliesmust be installed with the Headboard Assembly Kit.

Figure 3-9 and Figure 3-10 provides a simplified interconnect diagram for installation with the Coherent High Current Power Supply (MTM)or with the Coherent Low Current Controller (STM) with a heat sink riser, repectively. See Figure 3-12 on page 3-21 for locating pins on the headboard for the High Current installation.

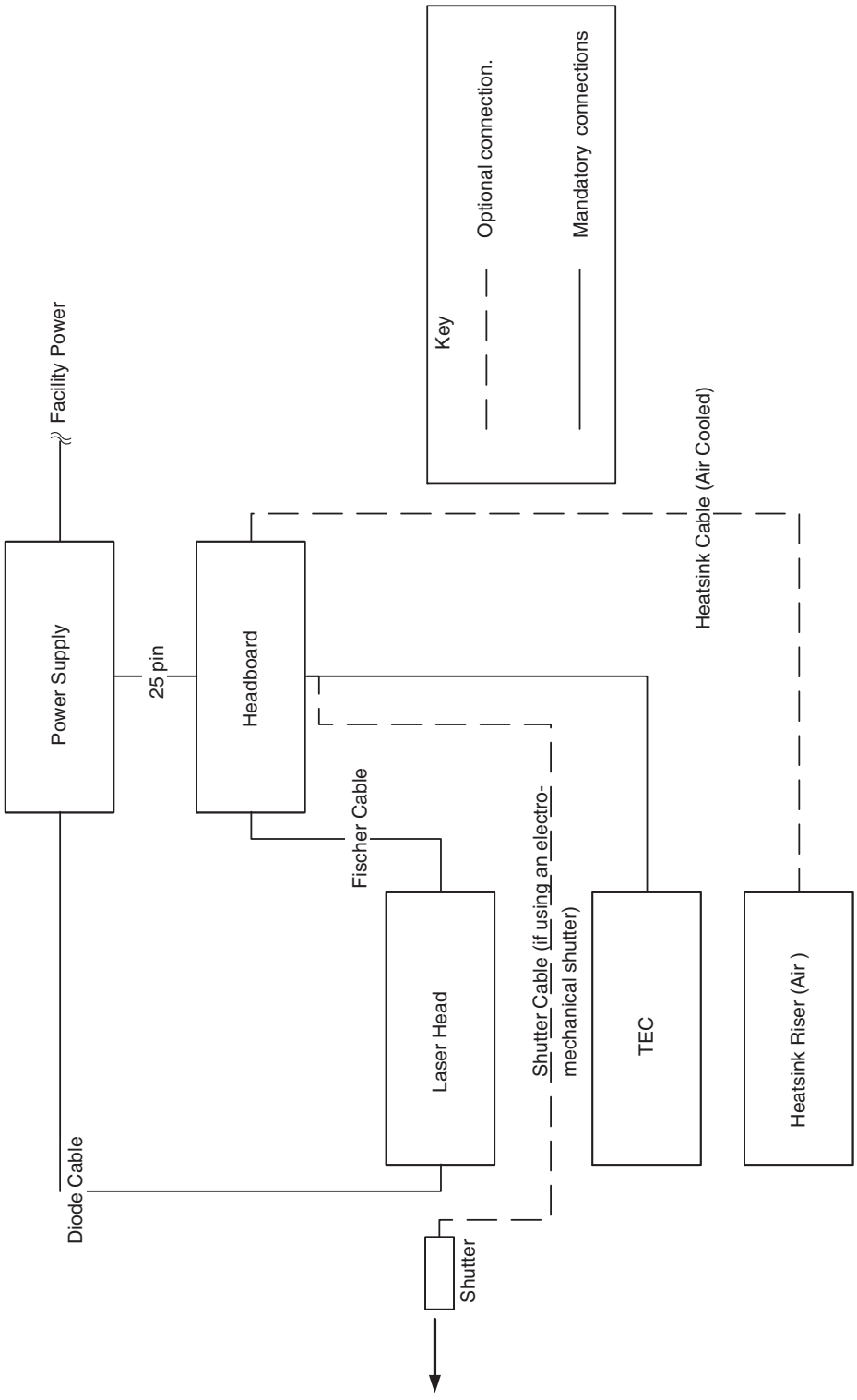



***Figure 3-9. Interconnect Diagram for Installation with High Current (MTM) Power Supply***

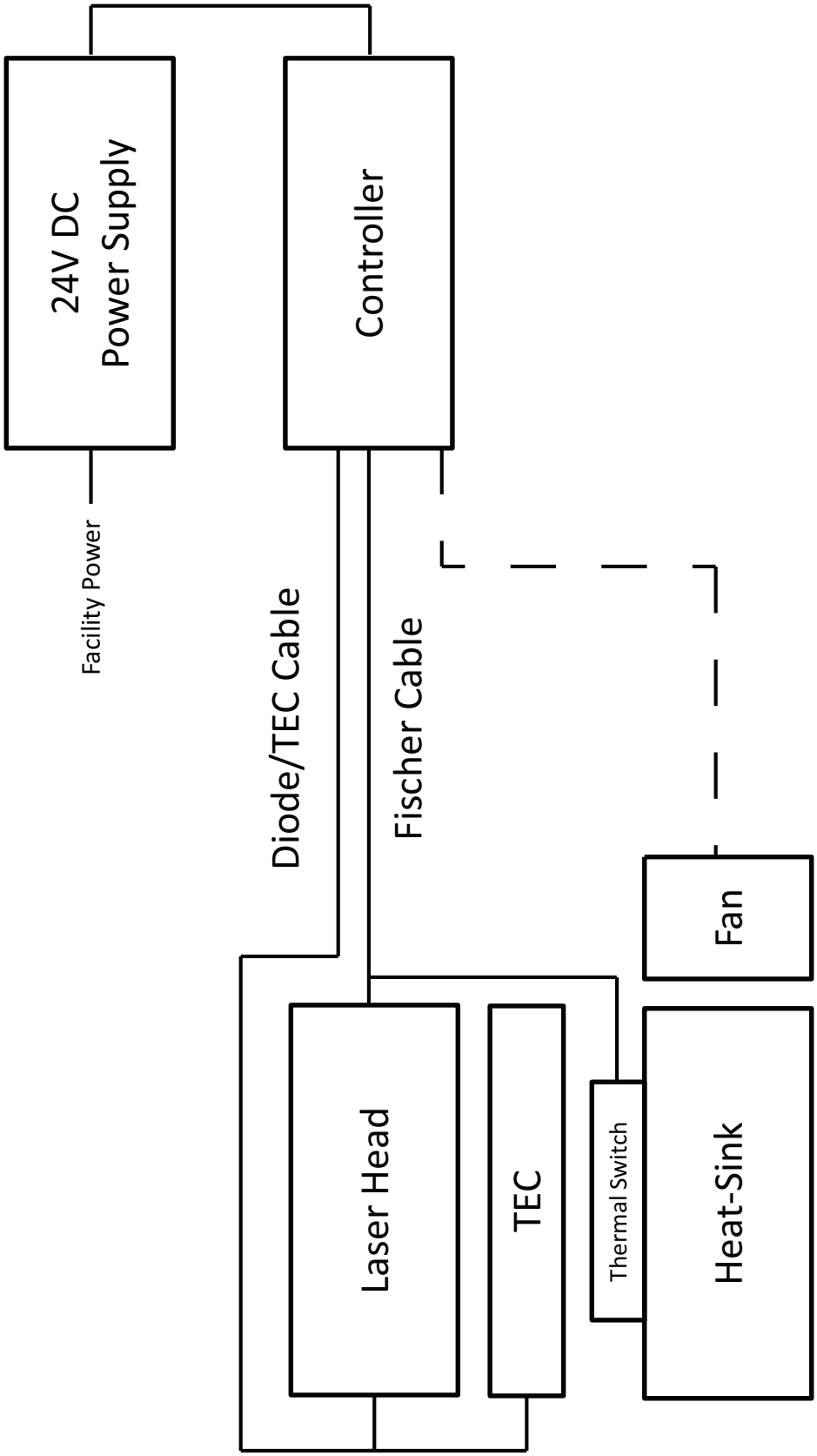



***Figure 3-10. Interconnect Diagram for Installation with Low Current (STM) Controller***

## Heat Sink Installation

If the Genesis MX Series is ordered with a heat sink riser, it will ship pre-installed. For air cooled risers, see “Electrical Installation” on page 3-20 for connection instruction. For water-cooled risers follow instructions below on "Chiller Installation".

## Chiller Installation

If using the Coherent water riser heat sink, the Thermotek™ Chillller (P/N 1112788) and Tubing Kit (P/N1172237) is recommended. The instructions below assume both are being used.

1. Connect hoses to the riser’s water inlet and outlet ports, and to the chiller’s inlet and outlet hose.
2. Pour distilled water in the chiller.
3. Plug chiller in to an AC outlet.
4. Turn on chiller and let the water cycle through the system.
5. Check water level and top off.
6. Set temperature between 20-25º C

***NOTICE!***
**Do not use DI water.**

## Electrical Installation

For detailed location of the connection ports of the power supplies, refer to Genesis Family Power Supplies Operator's Manual (P/N 1172849) shipped with the power supply.

Connect the red lead to the anode(+) and the black lead to the cathode(-). Connect the other end of the diode cable to the power supply.

Note the Diode Cable ends will differ depending on the mode of the laser head.

For MTM Power Supply, plug in the diode cable port.

For STM Power Supply screw in the appropriate leads to the power supply.

---

***NOTICE!***
**Leave the shorting clip in place during electrical installation. Failure to do so may damage the unit.**

---

***Figure 3-11. Connecting the Diode Cable***

**MTM/ High Current Power Supply Installation**

For installation of a MTM head with a MTM or High Current Power Supply, the headboard serves as a communication control between the laser head and the High Current OEM Power Supply or the Benchtop Power Supply.

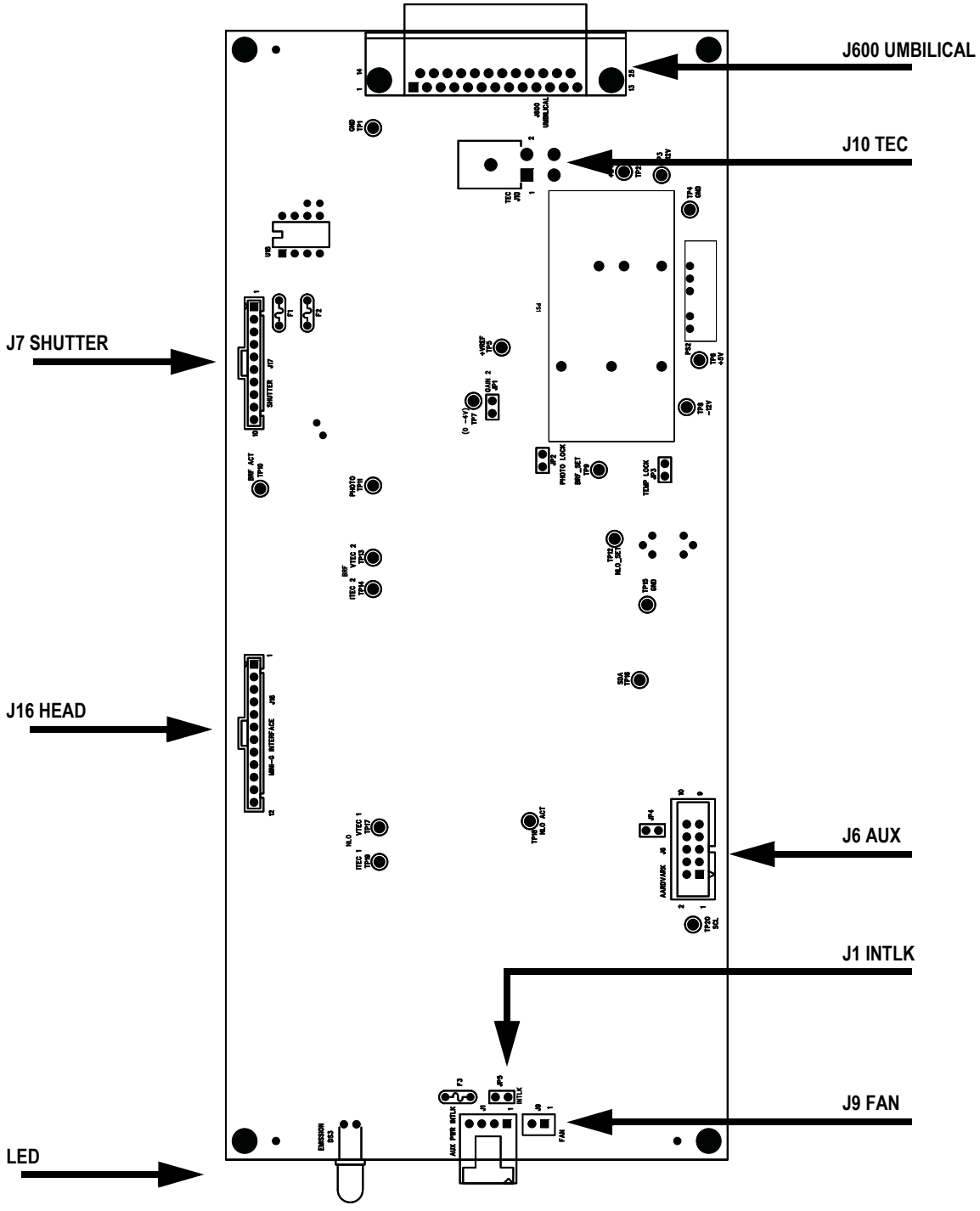



***Figure 3-12. Coherent Headboard***

1. Plug in the TEC cable to J10 on the head board.
2. Plug in the head cable to J16 on the board. Plug the Fischer™ connector end to the back of the laser head.
3. If unit was ordered with an electromechanical shutter, plug the shutter cable into J17 of the headboard. Skip this step for manual shutter.
4. If the unit was ordered with an air heat sink riser, connect the fan cable to J9 of the head board. Skip this step for water riser.
5. Connect the DB 25 pin cable to J600 of the head board, then connect to the power supply.
6. Plug the power supply into an AC outlet.
7. Remove the shorting clip.

---

**The headboard is individually mated to the head for specific characteristics and must be ordered with the MTM head and Coherent power supply.**

---

### STM/ Low Current Controller Installation

For installation of a STM head with a STM/Low Current Controller :

1. Plug in the TEC cable to the appropriate plug in the head connection panel of the controller.
2. Plug the Fischer™ connector end to the back of the laser head; plug the 12 pin end to the appropriate plug in the head connection panel of the controller.
3. If unit was ordered with an electromechanical shutter, a pulsed drive system that starts at 24 V and decays to 5V in 150 ms must be provided.[1] Skip this step for manual shutter.
4. If the unit was ordered with an air heat sink riser, connect the fan cable to the appropriate plug in the head connection panel of the controller. Skip this step for water riser.
5. Screw in power cable to the External Connection Panel of the controller and connect it to the exernal power supply.[2,3]
6. Plug external power supply into an AC outlet.
7. Remove the shorting clip.

---

1. STM/Low Current Controller does not have an outlet for electromechanical shutters.
2. See Operator's Manual Genesis Family Power Supply P/N 1172849 and http://www.cosel.co.jp/en/products/pdf/SFE_PBA300-1500.pdf for details.
3. No cable provided.

## *Interlocks (All Coherent power supply models)*

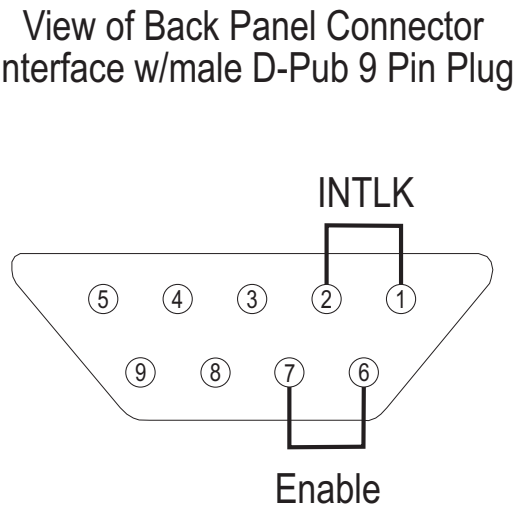



***Figure 3-13. External Interlock***

### External Interlock

The system is shipped with a panel interlock connector (see Genesis Family Power Supplies Operator's Manual P/N*1172849* for location of the interlock connector). 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.

***NOTICE!***
**When the interlock is opened, the unit will terminate laser emission. An optical isolated transistor like the MOC213 or a dry contact relay for both the Enable and Interlock interfaces is recommended. The external circuitry must be able to handle 12.5mA of current and withstand as much as 24V (positive on pins 1 and 6). When on/closed it should have less than 1V of drop**

***Table 3-7. External Interlock Pins***

| 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 keyswitch. A switch placed between these pins will be connected in series with the keyswitch. |

## Analog Control

The laser can also be remotely controlled by means of suitable signals at the interlock connector, as shown in figure Figure 3-14.

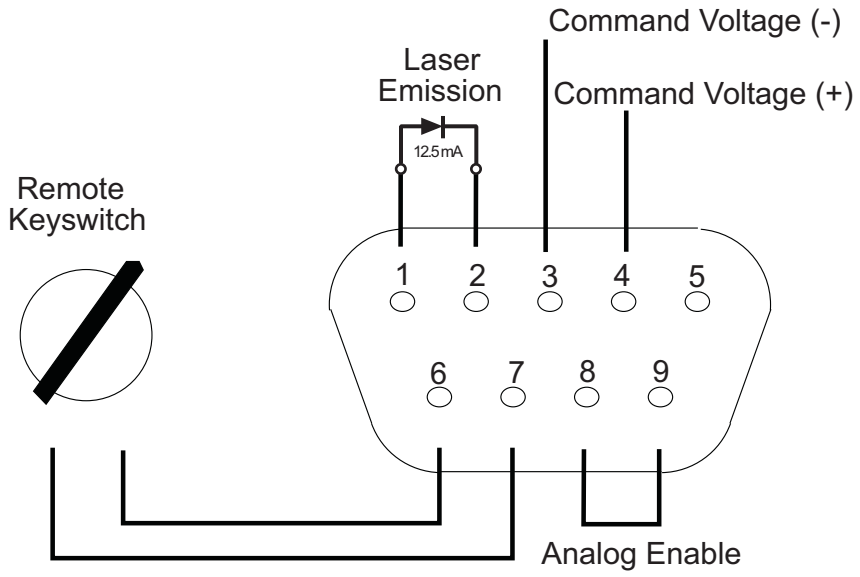



***Figure 3-14. Interlock Connector***

- 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.
- For high current models (MX MTM, CX STM/SLM), V-I conversion is 5V=100A in Current Mode.
- For low current models (MX STM), V-I conversion is 5V=20A in Current Mode.
- For all models 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.

## *OPSL Software Installation*

The Computer Control is required for operating the Low Current Controller and the High Current Power Supply if Analog Control is not used. This is an optional feature for the Benchtop Power Supply.

1. Insert the supplied CD in the computer (Windows® XP, 2000, 7 and 8 compatible).
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 3-15.


***Figure 3-15. Decline Option***

4. Select the option to look for drivers in a specific location, see Figure 3-16.


***Figure 3-16. Software Location***

5. Browse to the location of the driver folder in the CDM 2.04.06 WHQL Certified, see Figure 3-17.

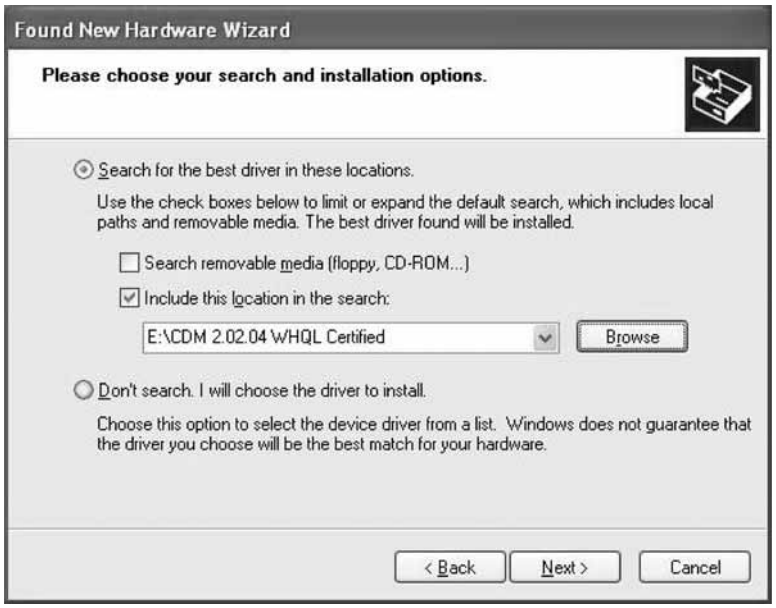



***Figure 3-17. Driver Location***

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.

# *Selecting a Fiber for Coupling*

## Determining the Embedded Beam Radius

The Genesis MX Series produces a multimode output beam characterized by the optical invariant beam quality $M^2$ related to the waist size $\omega_0$ and the far field divergence $\theta$ through the following formula:

$$M^2 = \frac{\pi \omega_0 \theta}{\lambda}$$

A useful theoretical construct in dealing with multimode beams is the concept of "embedded Gaussian". A multimode beam which has a waist M (not $M^2$) times larger than the embedded Gaussian will propagate with a divergence M times greater than the embedded Gaussian, and the multimode width will always be M times the embedded Gaussian width, but will have the same radius of curvature and the same Rayleigh range.

As an example, from the specification table, the horizontal, typical characteristics are: $M^2 = 5.6, 2\omega = 1.15\text{mm}, \theta = 17.5\text{mrad}$, and the waist is 65 mm into the laser. These quantities actually over-specify the beam.

The divergence[1] of the embedded Gaussian beam is $17.5\text{mrad} / 2 / \sqrt{5.6} = 3.7\text{mrad}$. As the embedded beam is a perfect Gaussian ($M^2 = 1$), by using the formula above, with $\lambda = 532\text{nm}$, the waist[2] of the embedded beam is: $\omega_0 = 45.8\mu m$, to double check our numbers the waist radius

1. Assume half angle at $1/e^2$ for divergence throughout document.
2. Assume radius at $1/e^2$ for waist throughout document.

located at z = 65 mm into the laser and the size of the embedded beam at the output is

$$\omega = \sqrt{\omega_0^2 + \left(\frac{z\lambda}{\pi\omega_0}\right)^2}$$

244.7 µm. To get to the real beam diameter multiply the waist radius by 2 and by the square root of $M^2$ to get 1.158 mm, close enough to the number we specify.

## Determining the Fiber Radius for Coupling

The scenario below illustrates a method for finding a fiber with the correct dimensions for coupling with the laser.

A 7 mm focal length lens is placed 25 mm from the laser, to focus at an embedded beam with waist of 3.8 µm, and divergence of 44.3 mrad. The real beam is M times larger (in this example, $M = \sqrt{5.6}$, so the beam waist is 9 µm converging at 105 mrad. However, as these are values at $1/e^2$ , power extends beyond the calculated radius of the beam. Therefore, to determine the correct NA[1] and diameter for the fiber, multiply the NA and the beam radius at $1/e^2$ by 2 and 4 respectively. In this example NA=0.21 and the diameter=36 µm. The conclusion, according to the chart in Figure 3-18 is that a 0.22NA fiber with 50 µm core couples with high efficiency with this beam.

More generally, the beam quality places some restrictions on the fibers (core diameter and numerical aperture) that can be used efficiently with the Genesis MX Serieslaser. For the users' reference, we calculated the data shown in the curve below using the “embedded Gaussian” concept, for typical beam characteristics of the beam in the horizontal direction.

## Installing the Optical Fiber

1. Remove the protective cap off of the fiber port and fiber.
2. Insert the fiber to the fiber port at an angle as to not scratch the fiber interface.
3. Tighten the fiber to the port by turning the fastener on the port until it can no longer be turned.

1. NA=nsinθ

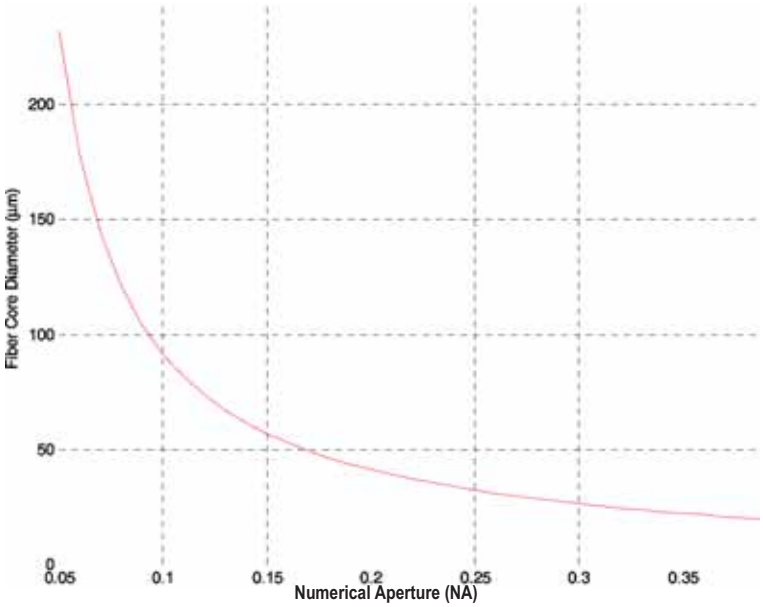



***Figure 3-18. Fiber Selection Curve***

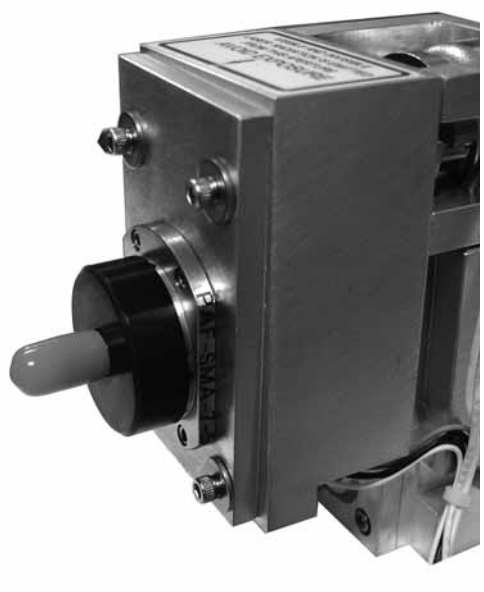


***Figure 3-19. Fiber Port with Protective Cap***

***Figure 3-20. Insert Fiber at Angle***

***Figure 3-21. Fiber Connected to Port***

# *Dimensions*

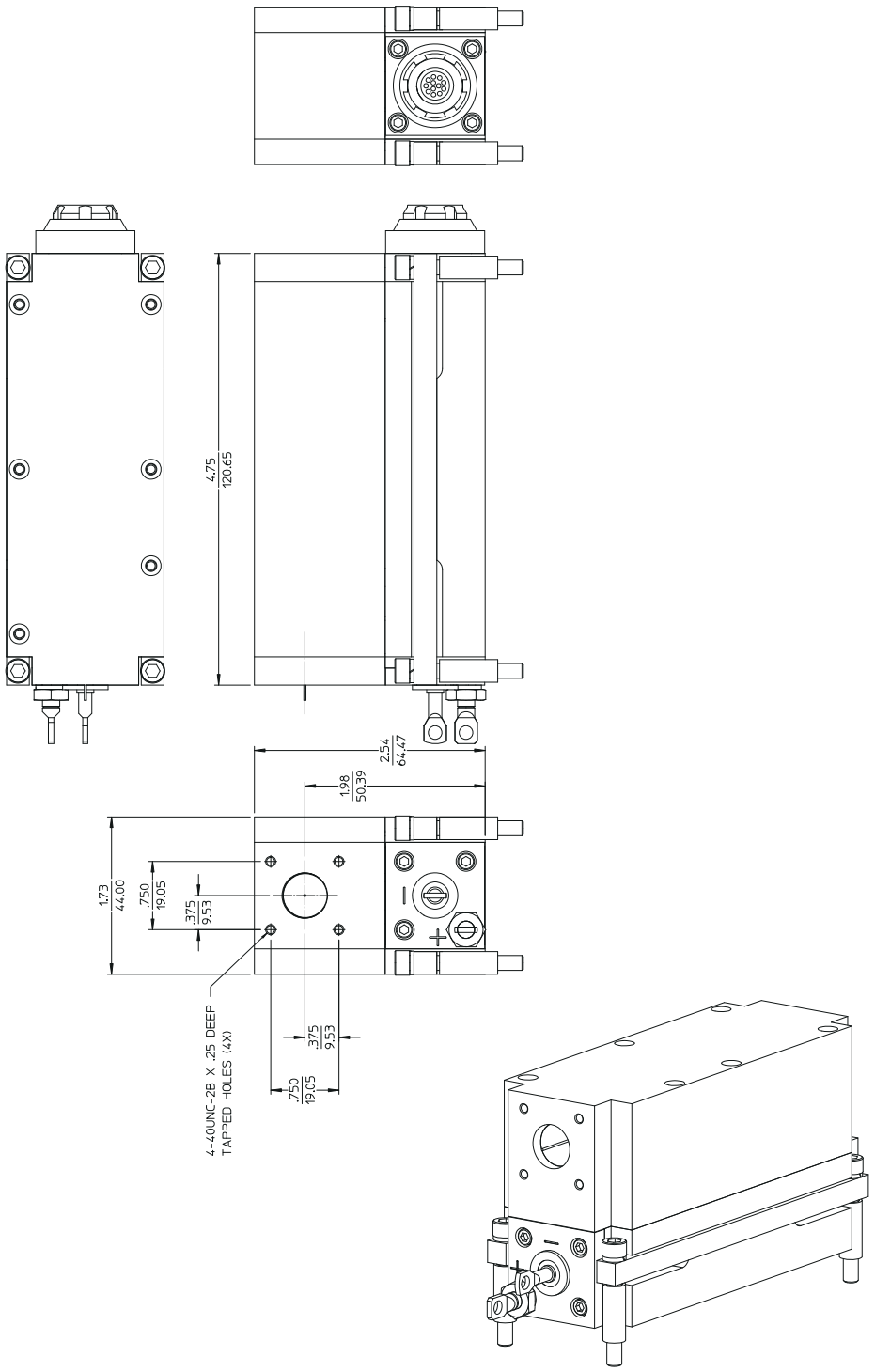



***Figure 3-22. Genesis MX Series MTM Head***

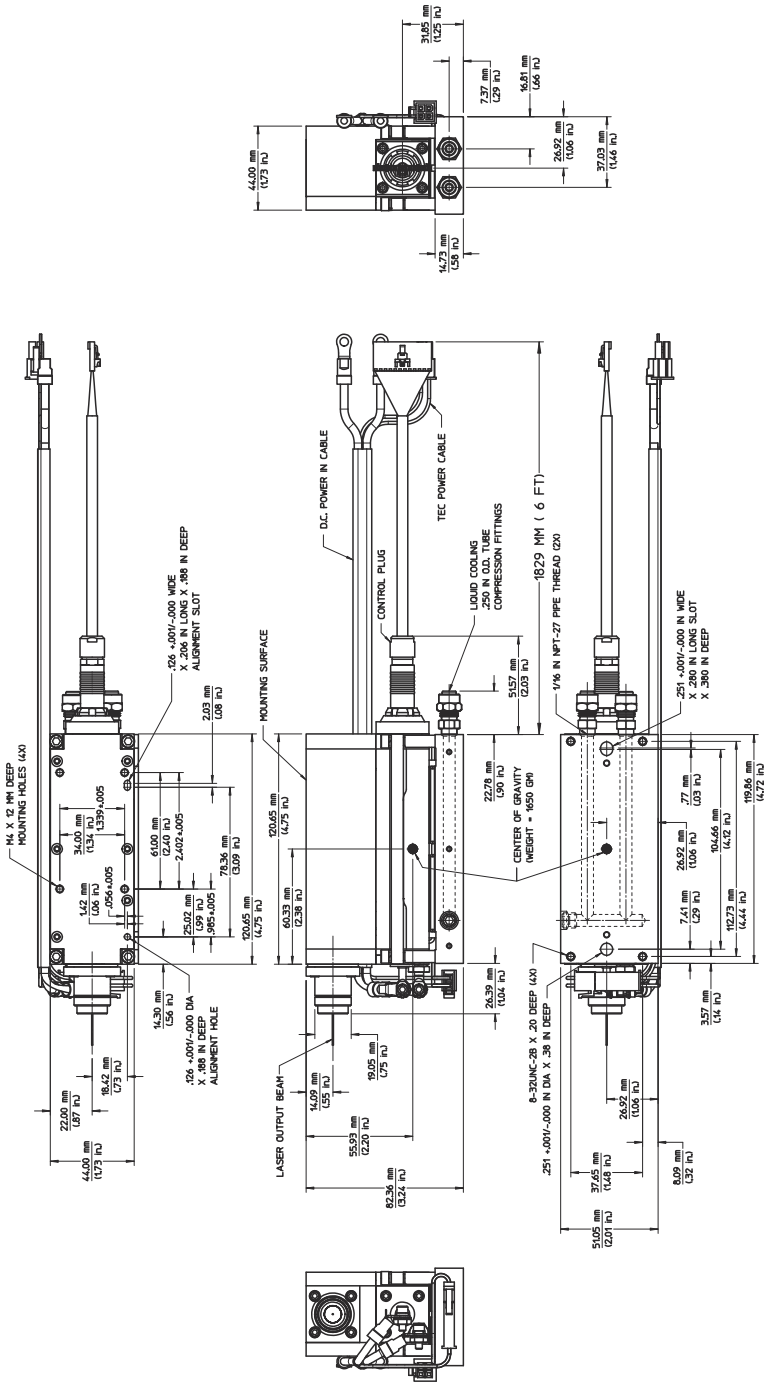



***Figure 3-23. Genesis MX Series STM Head***

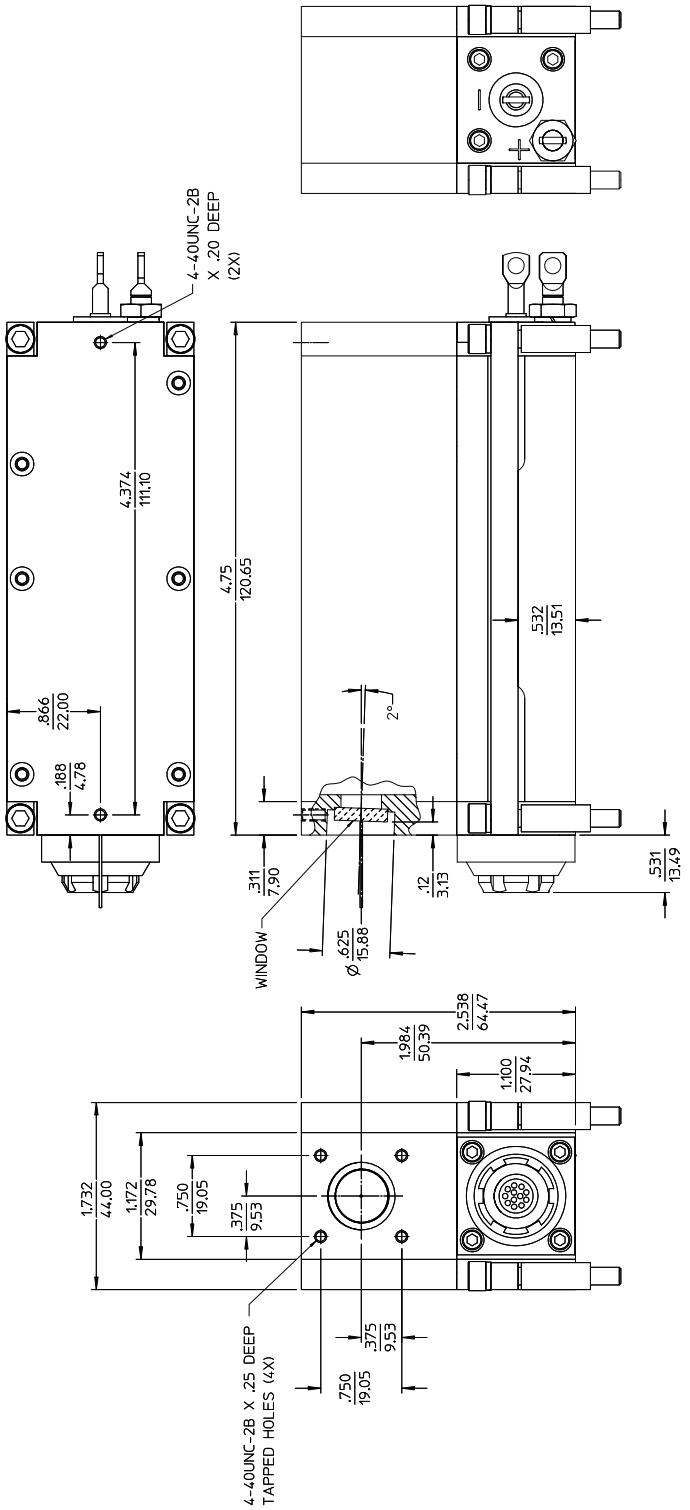



***Figure 3-24. Genesis MX Series IR Laser Head***

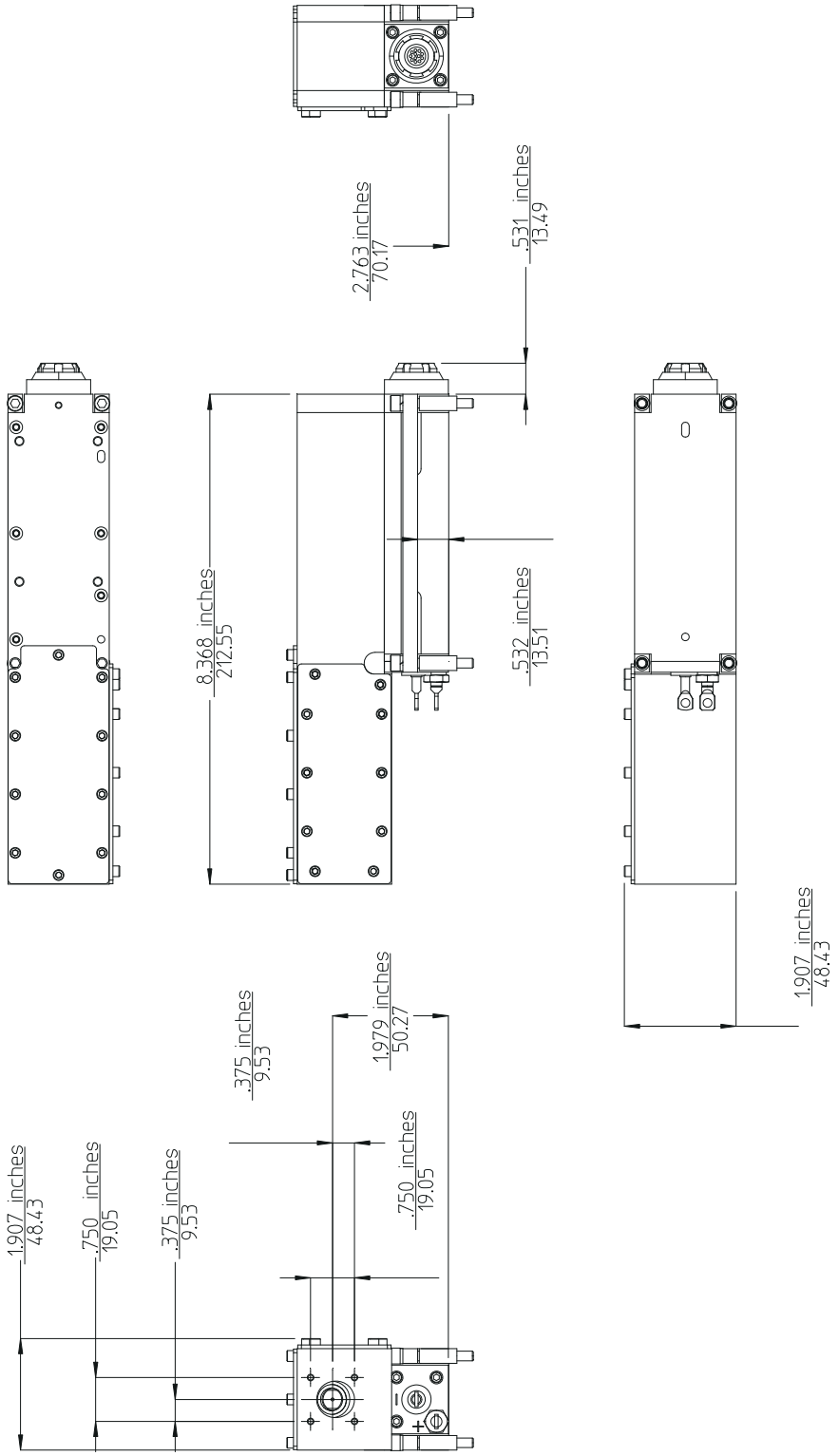



***Figure 3-25. Genesis MX Series 607-639 MTM Head***

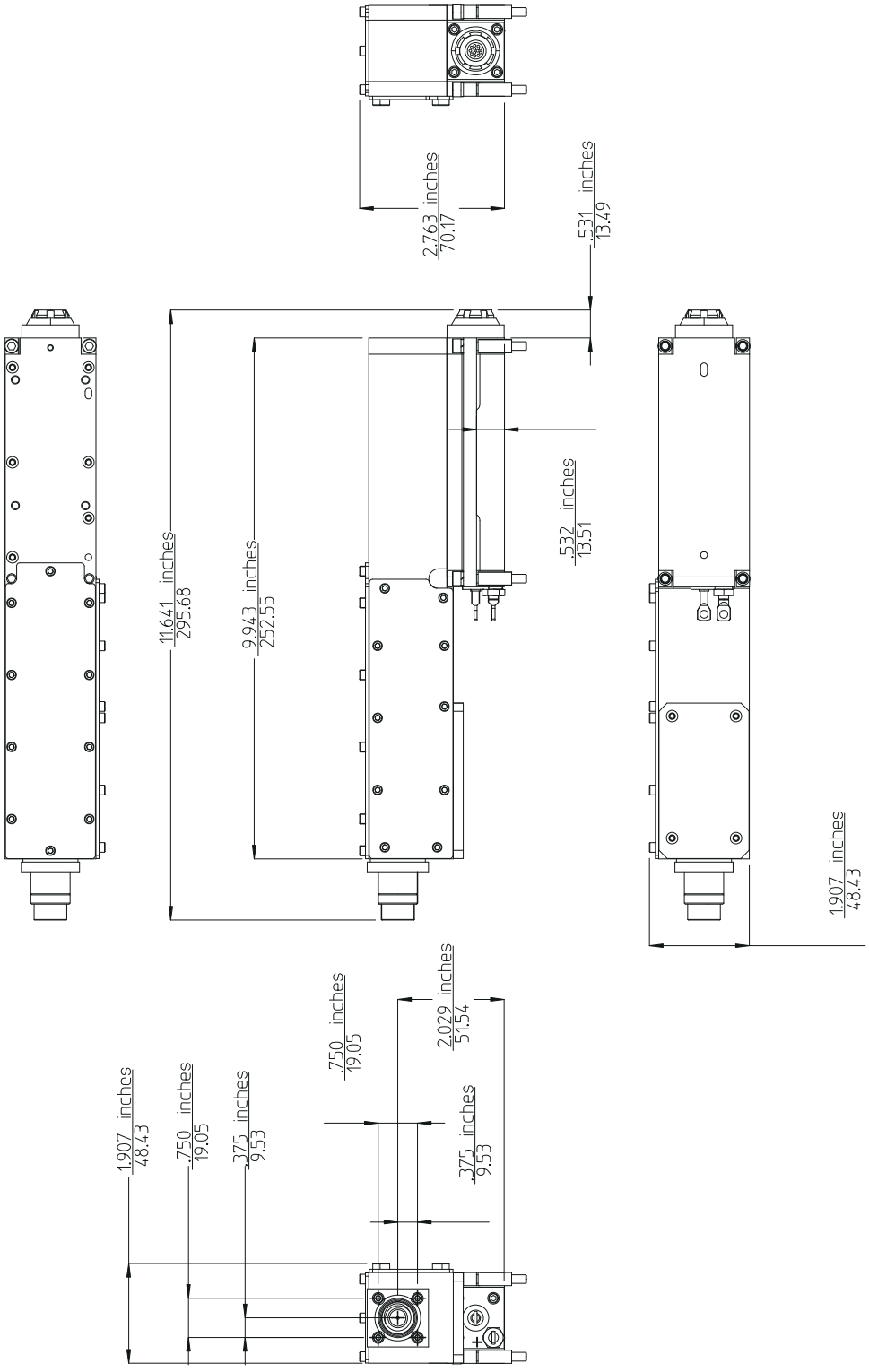



***Figure 3-26. Genesis MX Series 607-639 STM Head***

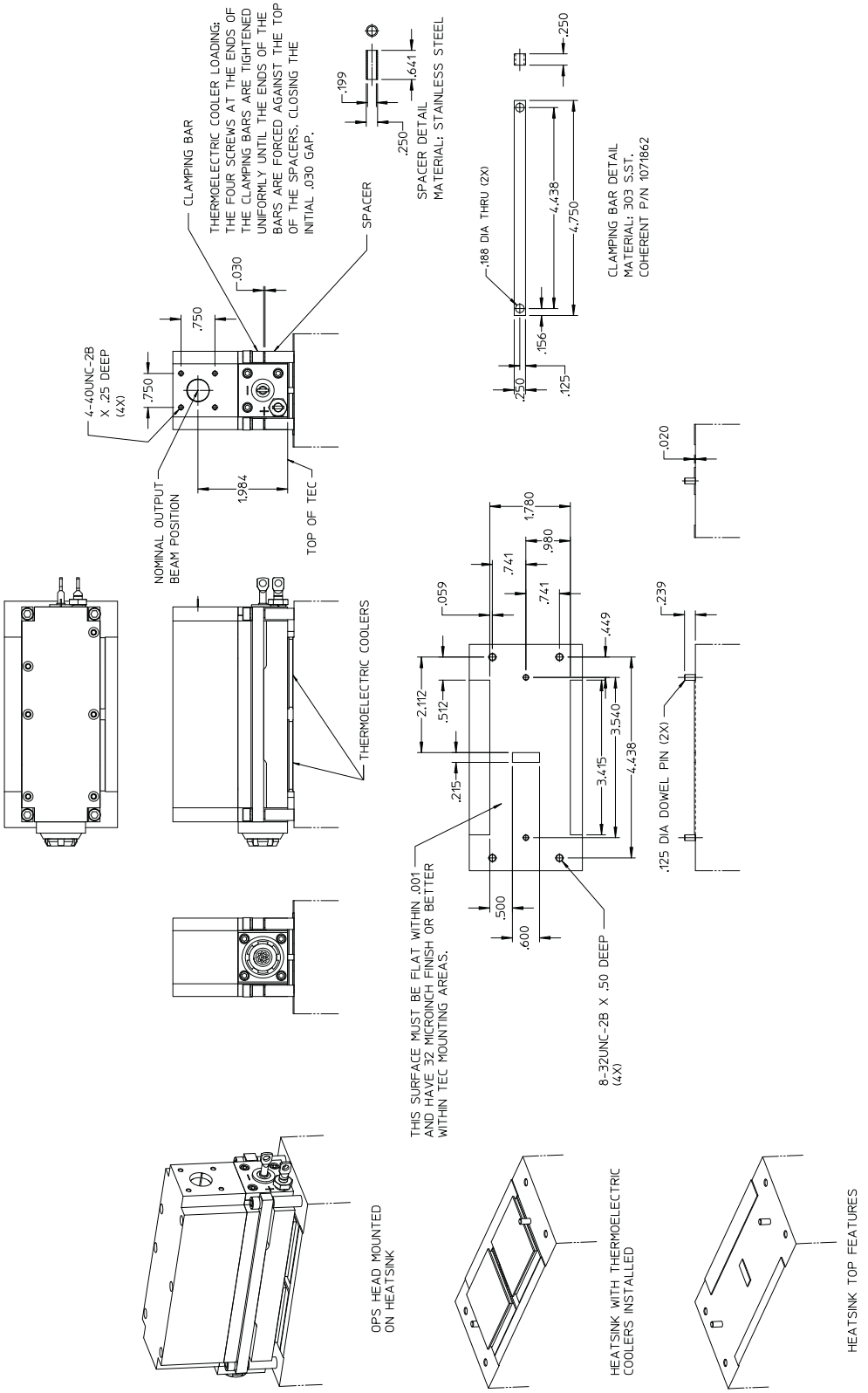



***Figure 3-27. MX Head Mounted to TEC***

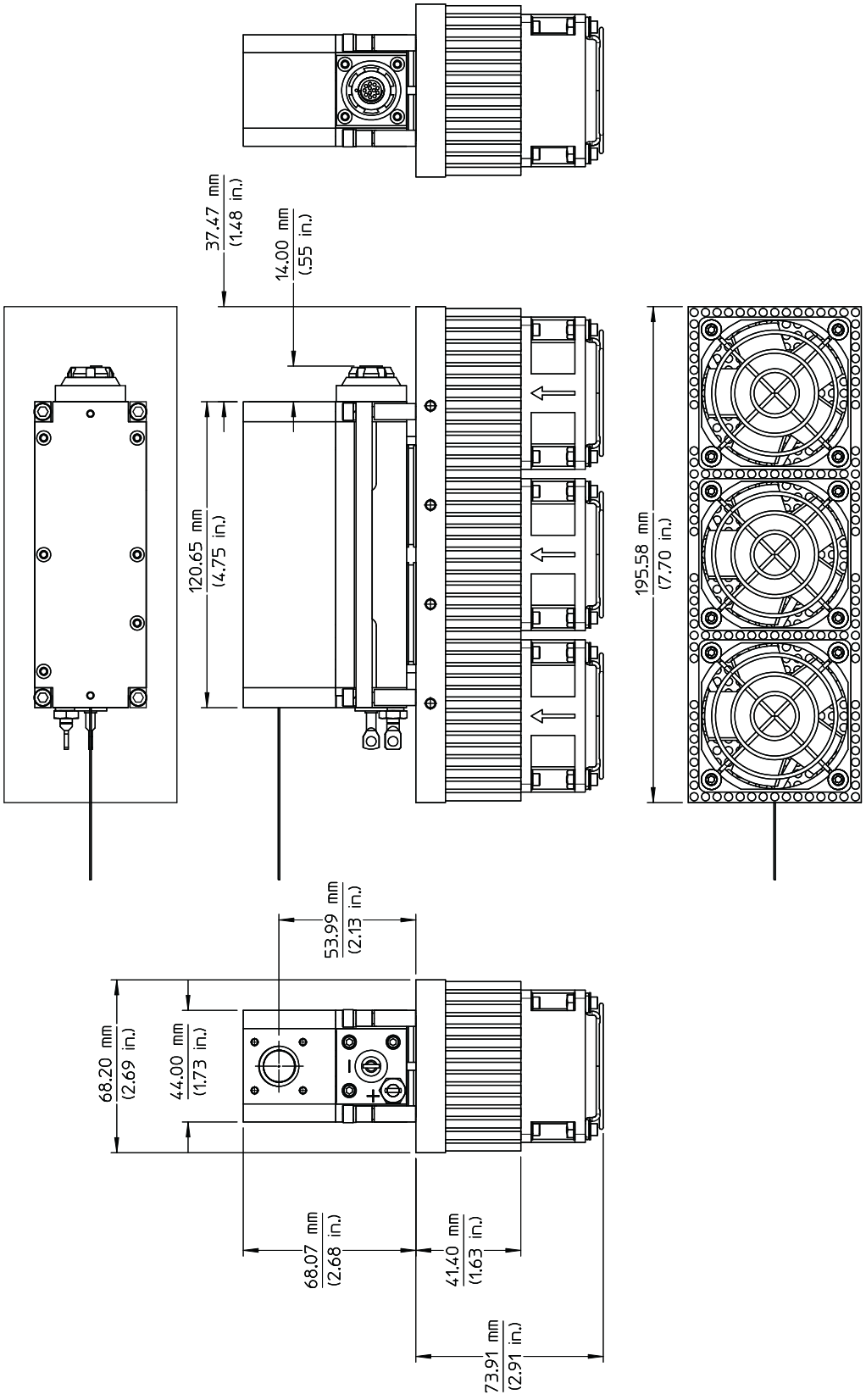



***Figure 3-28. Genesis MX MTM on Air Riser***

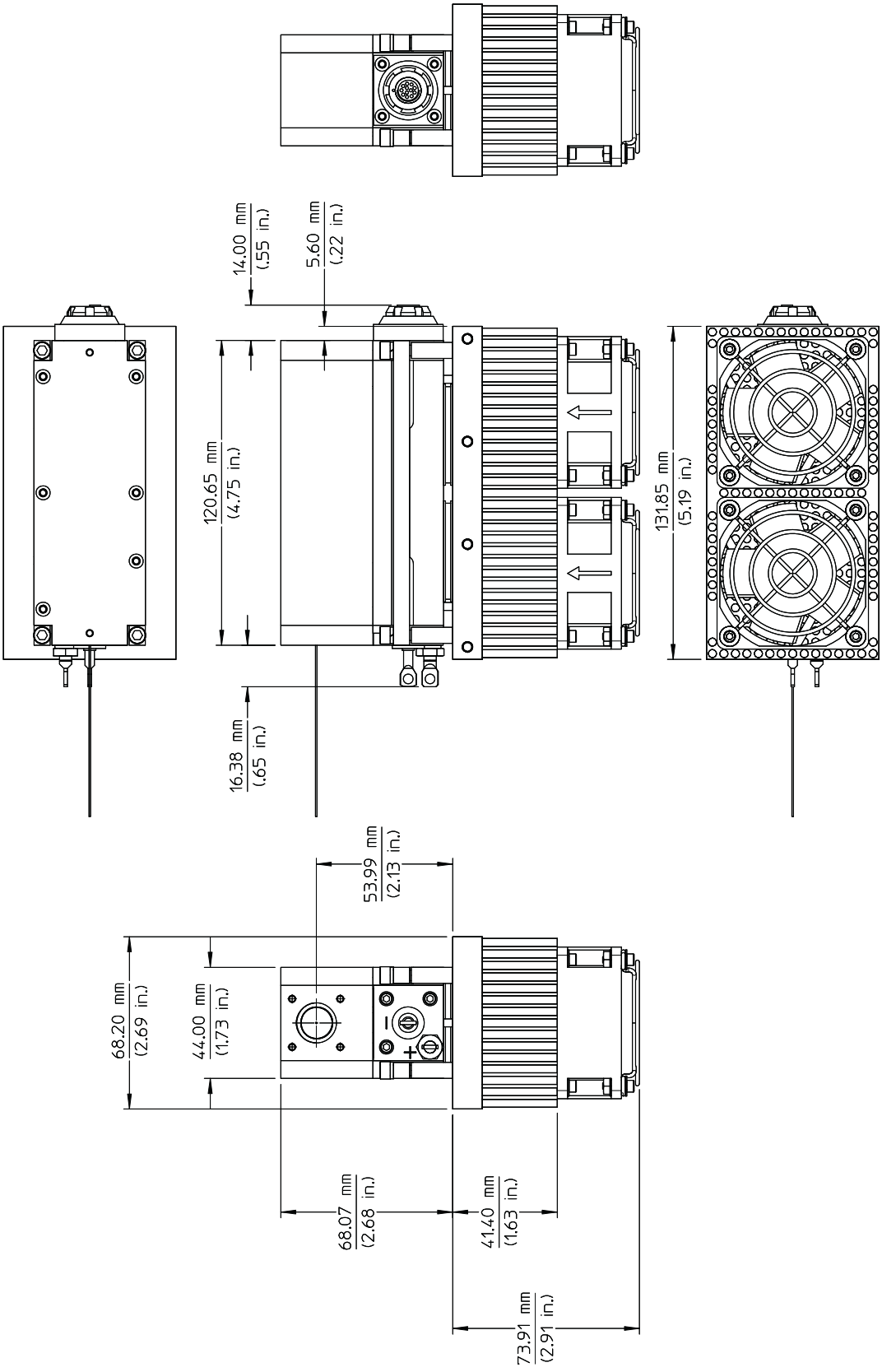



***Figure 3-29. Genesis MX STM on Air Riser***

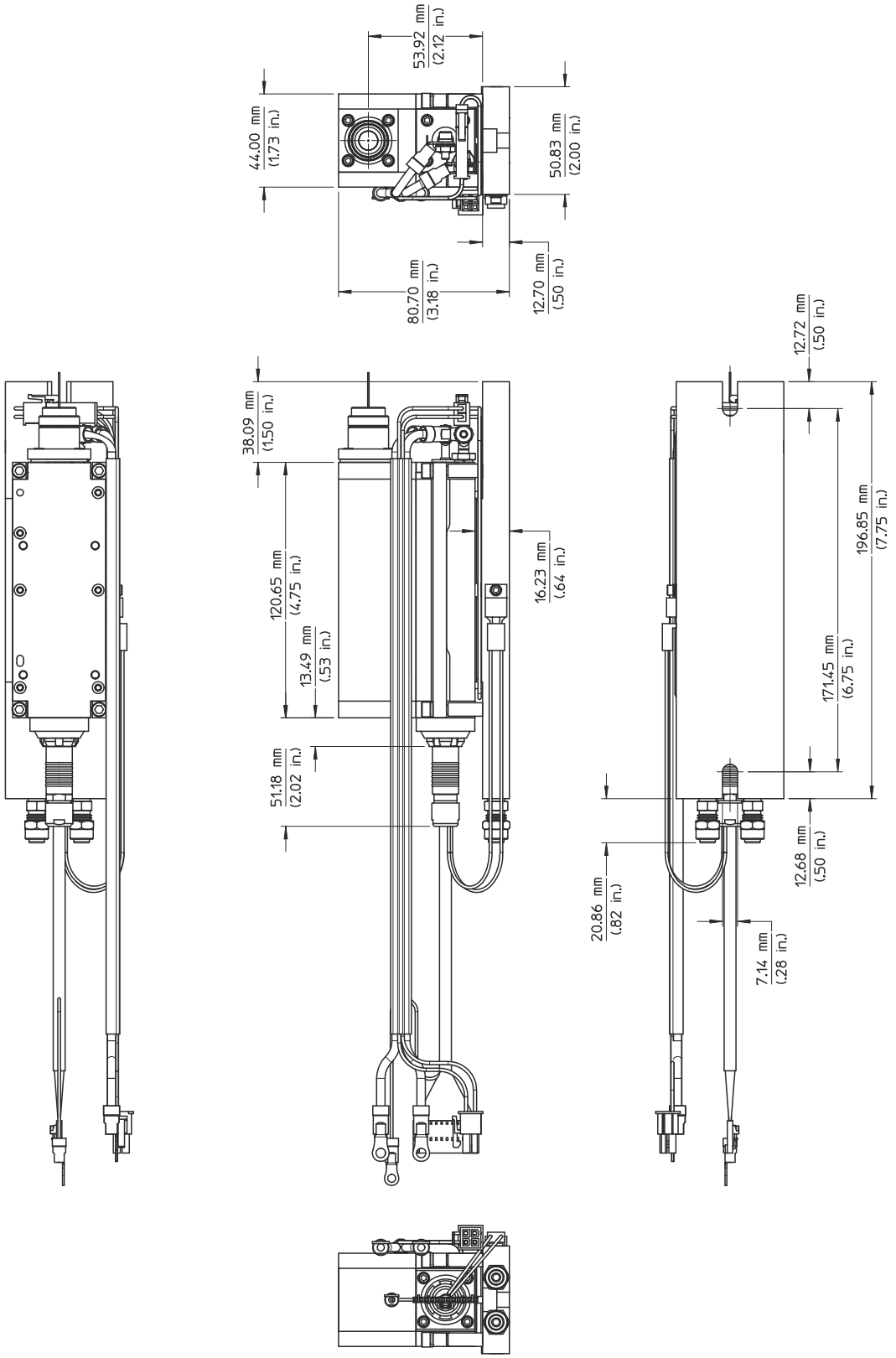



***Figure 3-30. Genesis MX OEM MTM on Water Riser***

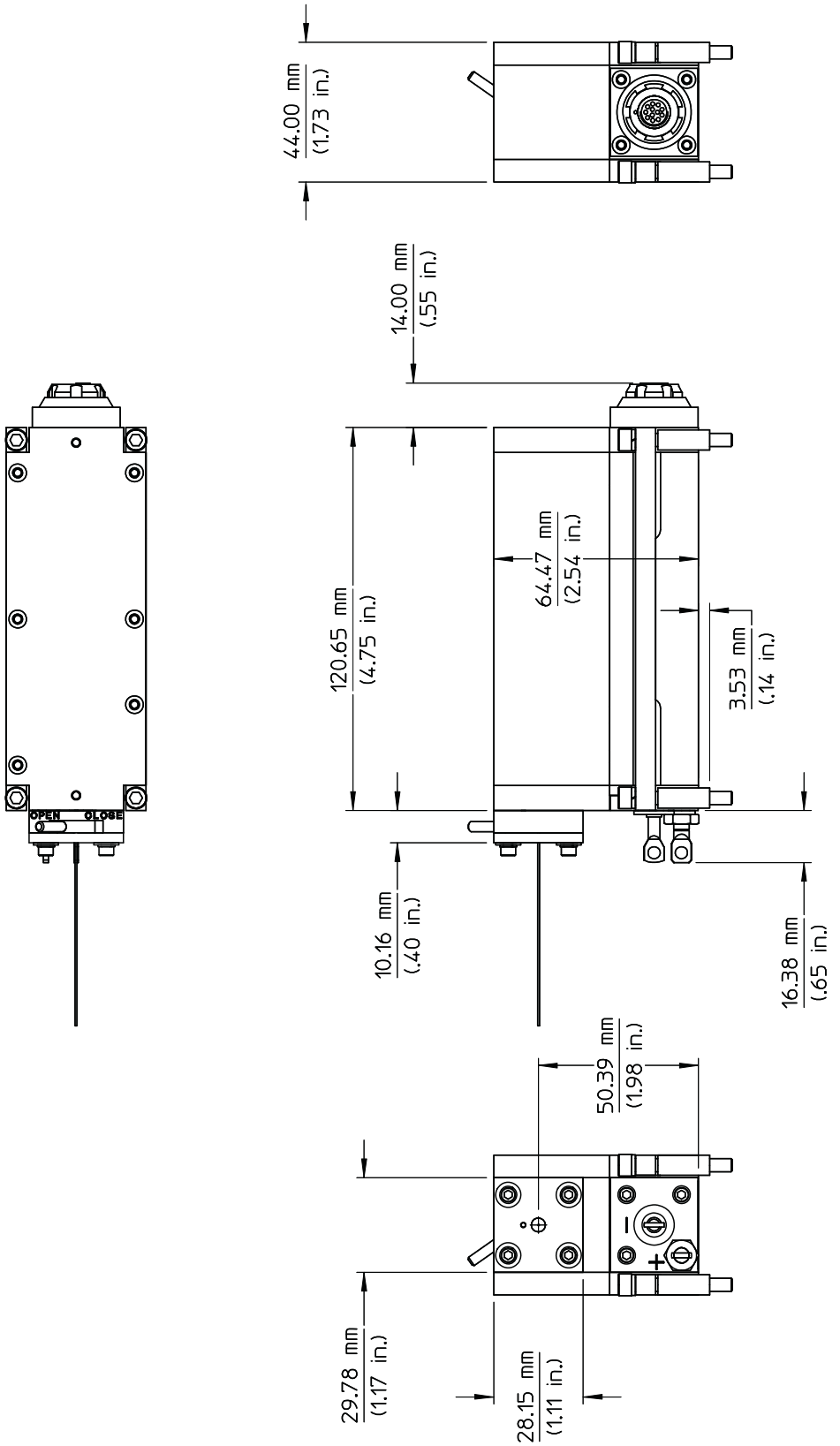



***Figure 3-31. Head Dimensions with a Manual Shutter***

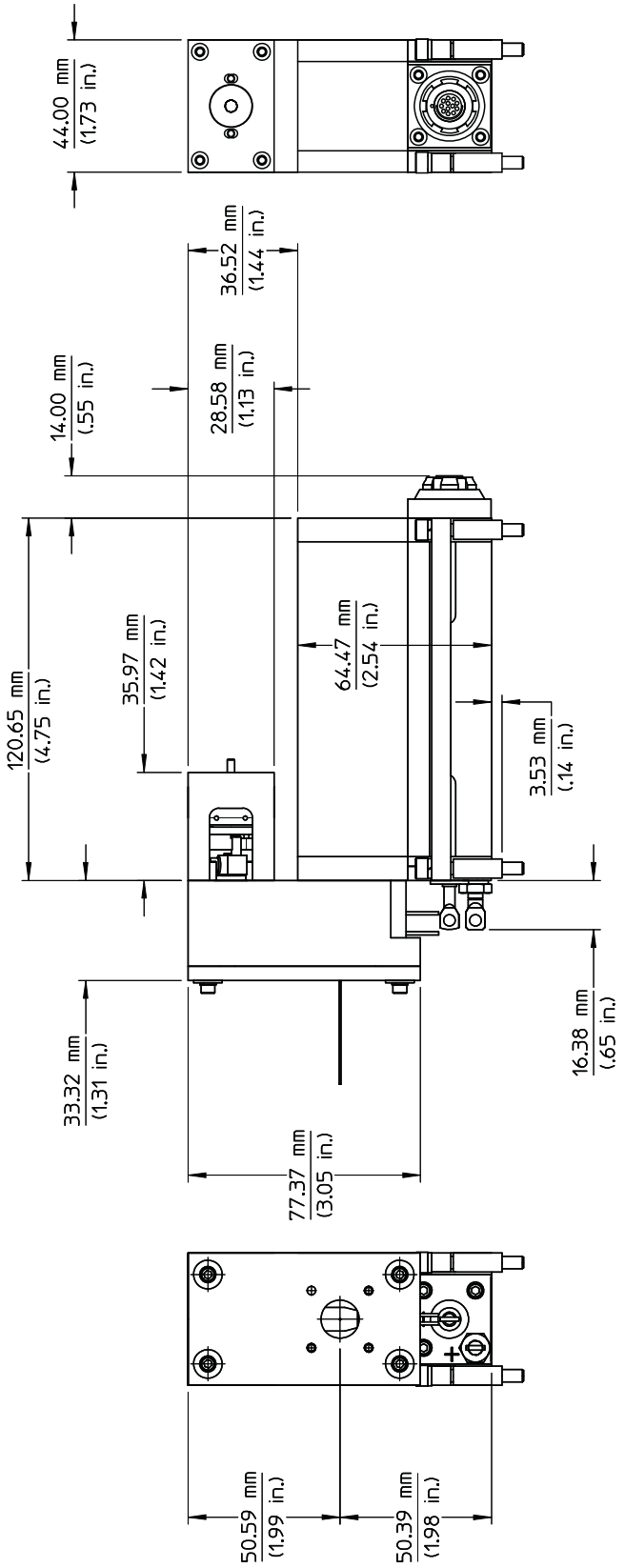



***Figure 3-32. Head Dimensions with Electro-Mechanical Shutter***

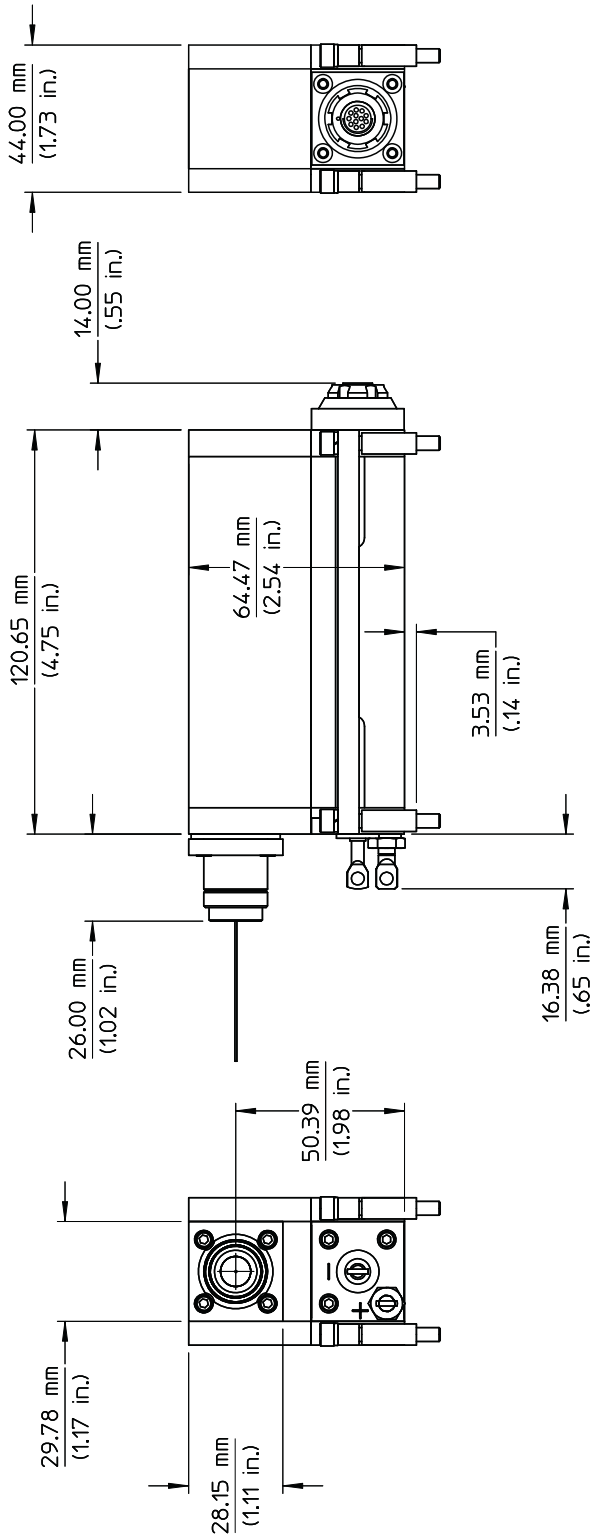



***Figure 3-33. Head Dimensions with Collimator***

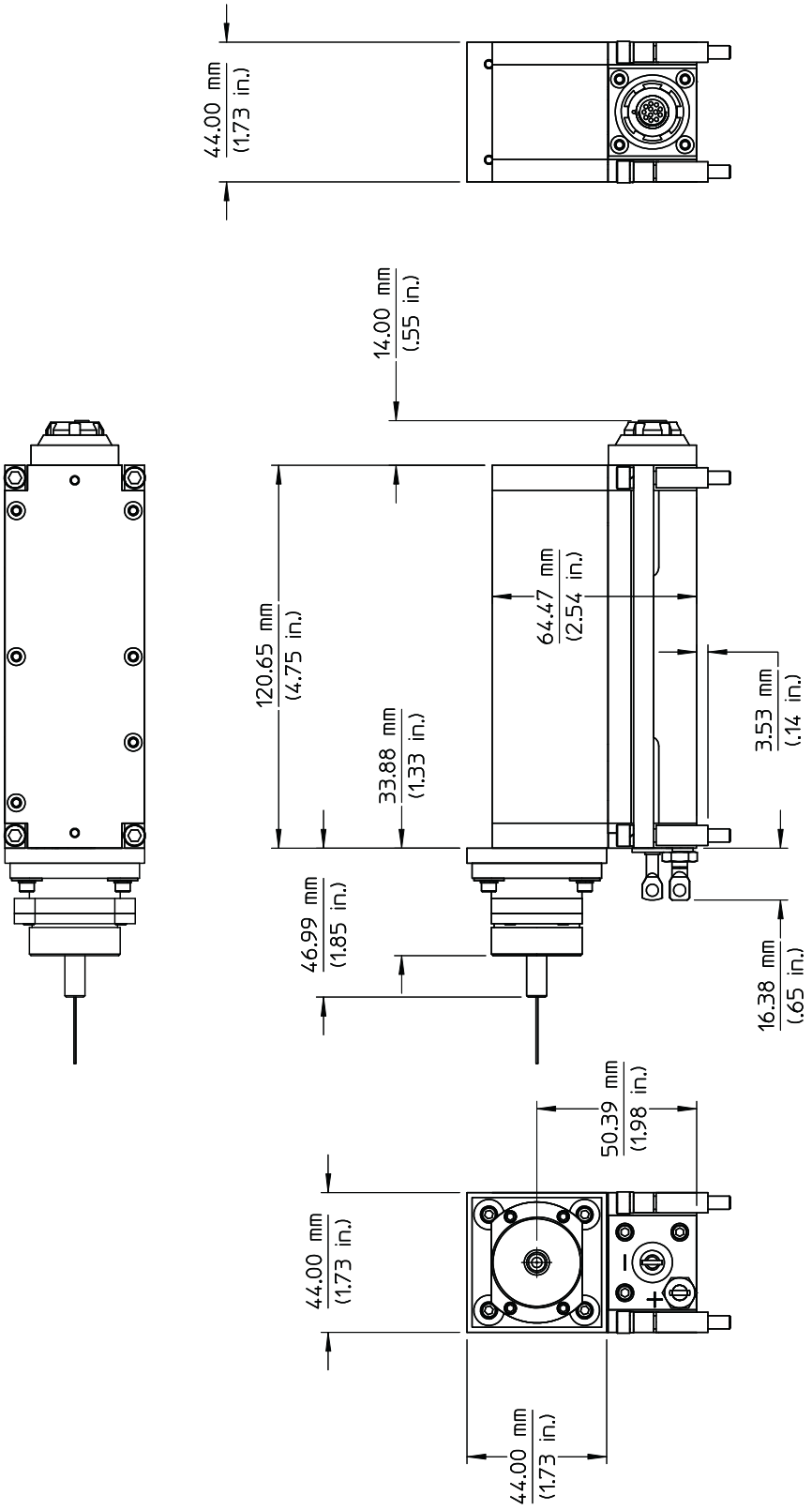



***Figure 3-34. Genesis MX Head with SMA Fiber Port***

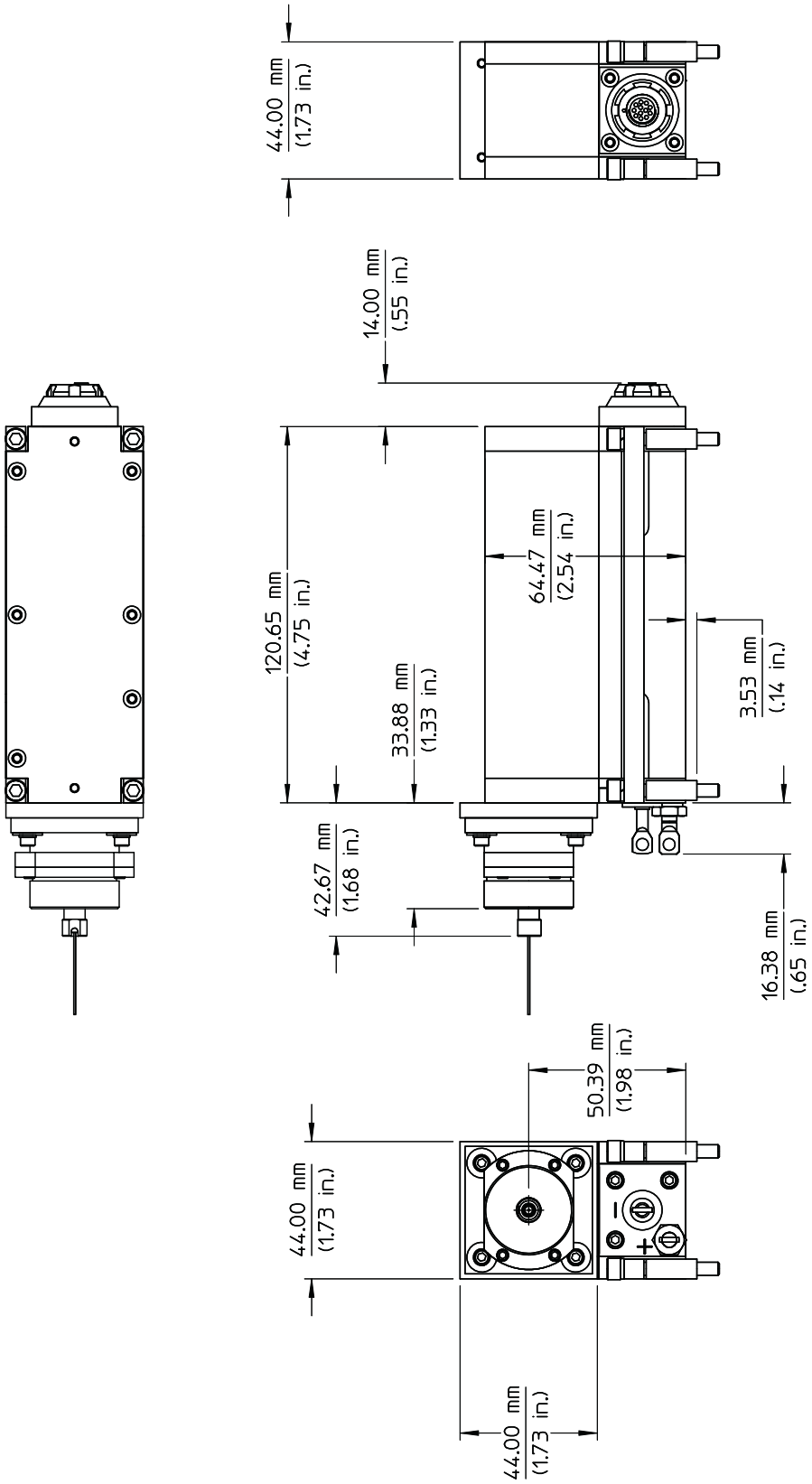



***Figure 3-35. Genesis MX Head with FC Fiber Port***

# SECTION FOUR: OPERATION

## *Introduction*

Operating instructions is dependent on the OEM, therefore, the first part of this section provides precautions and warnings in cases where a non-Coherent power supply is integrated with the Genesis™ MX Series. The second part of this section will discuss operating the Genesis™ MX Series with the Coherent power supply.

## *General Operating Precautions*

**NOTICE!**
**A dry environment should be provided by the user when operating at temperatures below ambient dew point. Failure to do so will cause condensation on the unit and can destroy it.**

**Failure to supply an adequate heat sink will destroy the unit.**

**Care should be taken to avoid back reflections into the unit. Failure to do so can destroy the unit.**

**Reverse voltages in excess of 3 V can destroy the unit.**

**NOTICE!**
**Use proper grounding procedures when disconnecting the shorting clip. Failure to do so may damage the unit.**

**NOTICE!**
**Ensure that the protective cover has been removed from the output window. Failure to do so may burn the cover and permanently damage the output window.**

**DANGER!**
**Optical radiation emitted from the** Genesis™ MX Series **can cause eye damage and ignite combustibles. Control scattered light and wear appropriate protective eye gear. Ensure the output is directed at a suitable beam stop or intended target.**

At low drive currents, the laser will have insufficient gain to lase. As the drive current is increased, the laser will reach threshold current, where it will have sufficient gain to lase. Further increases in current will cause an increase in output optical power up to the specified operating power.

Although the lasers were designed and optimized for CW operation, they can be modulated to accommodate other usage patterns. Given the amount of current necessary to operate the lasers, the limiting factor for modulation speed is the ability to modulate the diode current. Typical modulation readily achieves 5-10 µs rise and fall times, which is limited by the inductance of long wires between the power supply and the laser head.

In general, semiconductor devices perform better at lower operating temperatures. Great care should be taken in providing adequate means of heat removal.

**NOTICE!**
**To avoid thermal runaway of the system, a heat sink with low thermal impedance must be used.**

The laser cavity includes a birefringence filter (BRF) and second harmonic generator (SHG). Each of them is temperature controlled using an individual small TEC and negative temperature coefficient (NTC) thermistor. An internal photodiode is available for light loop regulation and noise reduction.

**NOTICE!**
**OEM assumes all responsibilities for damages to laser, equipment or personnel when using a power supply from sources other than Coherent. Should the laser head be integrated with power supplies from other vendors, be sure to read and understand Warning Notes for Operation with Non-Coherent Power Supplies of this section in its entirety prior to 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. Ensure all personnel in the area are wearing laser safety glasses.**

## *Warning Notes for Operation with Non-Coherent Power Supplies*

In addition to General Operating Precautions on "General Operating Precautions" on page 4-1, the following precautions must be observed when operating with non-Coherent power supplies.

**NOTICE!**
**Reverse voltages in excess of 3 V can destroy the unit.**

**Forward surge current in excess of 55 A even for only microseconds can destroy the unit.**

**Negative current transients greater than 25 µA can destroy the unit.**

**Exceeding the recommended optical output power specifications will accelerate aging and can destroy the unit.**

**NOTICE!**
**Coherent strongly recommends the use of a diode driver. Contrary to general purpose laboratory power supplies, diode drivers generally include protection against transients that could damage the pump diode.**

If a conventional laboratory supply is being used, set the voltage to 3 Volts (5 Volts maximum), and ramp up the current from zero to the operating point. The power supply will be operating in the constant current mode in this case. Reverse the procedure when turning the diode off.

**NOTICE!**
**Do not increase the applied voltage above 5 Volts. Higher applied voltages can damage the unit.**

## *Operation with Coherent Power Supplies*

The following provides operating instructions should the laser head be operated with a Coherent power supply and headboard.

Start-up procedures vary depending on the Coherent power supply purchased with the system. Refer to *Operator's Manual Genesis Family Power Supplies* P/N 1172849 for start-up instructions.

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.

**NOTICE!**
**A dry environment should be provided by the user when operating at temperatures below ambient dew point. Failure to do so will cause condensation on the unit and can destroy it.**

**Failure to supply an adequate heat sink will destroy the unit.**

**Care should be taken to avoid back reflections into the unit. Failure to do so can destroy the unit.**

**Reverse voltages in excess of 3 V can destroy the unit.**

**NOTICE!**
**Use proper grounding procedures when disconnecting the shorting clip. Failure to do so may damage the unit.**

**NOTICE!**
**Ensure that the protective cover has been removed from the output window. Failure to do so may burn the cover and permanently damage the output window.**

**DANGER!**
**Optical radiation emitted from the** Genesis™ MX Series **can cause eye damage and ignite combustibles. Control scattered light and wear appropriate protective eye gear. Ensure the output is directed at a suitable beam stop or intended target.**

**NOTICE!**
**To avoid thermal runaway of the system, a heat sink with low thermal impedance must be used.**

**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. Ensure all personnel in the area are wearing laser safety glasses.**

**NOTICE!**
**When performing a cold-start, ensure that the keyswitch of the power supply is 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 will remain off. The keyswitch will need to be turned off and back on to start the laser.**

**NOTICE!**
**When turning the keyswitch 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 keyswitch on prior to the laser coming up to operating temperature will result in a fault. The fault can be cleared only by turning the keyswitch off, and back on, provided that the laser has come up to operating temperature.**

## System Control (All models)

The Genesis™ MX Series can be controlled through two different interfaces.

- Full computer control through either USB or, in some models, RS-232D serial interface
- A more limited 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.

## Computer Control (All models)

### OPSL GUI (Graphical User Interface)

With the power supply connected to a user supplied computer through the USB interface, run the OPSL program. The program window will open as shown in Figure 4-1.

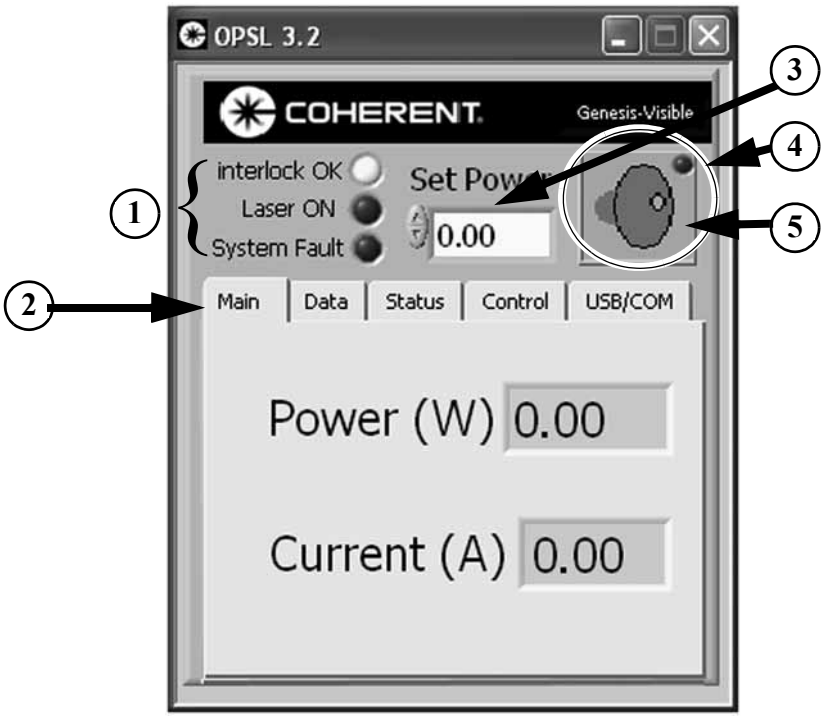
- The type of laser is recognized by the software and displayed in the black banner next to the Coherent logo.
- The status LEDs replicate the real ones on the front panels of the system.
- The Key-Switch in the GUI acts both as a control and as an indicator.
    - As a control, it can be used to turn 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.

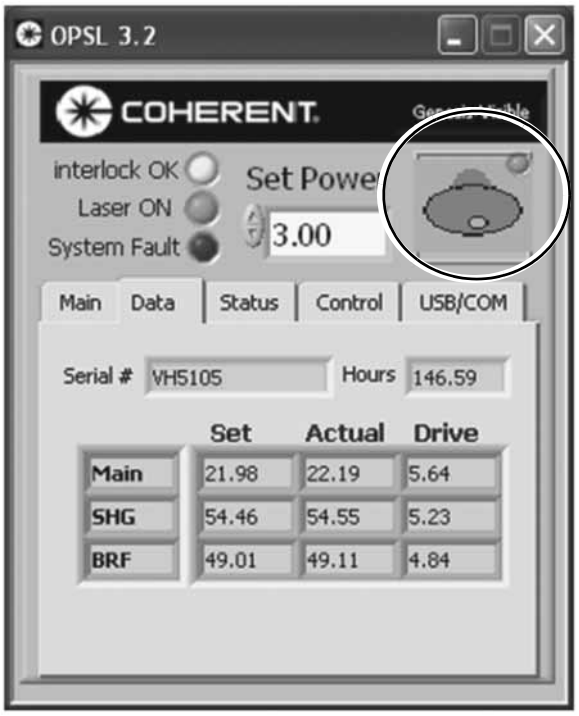
Note: It is good practice to take and save screen shots at initial installation. Screen shots can be compared at a later time for trouble-shooting.




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

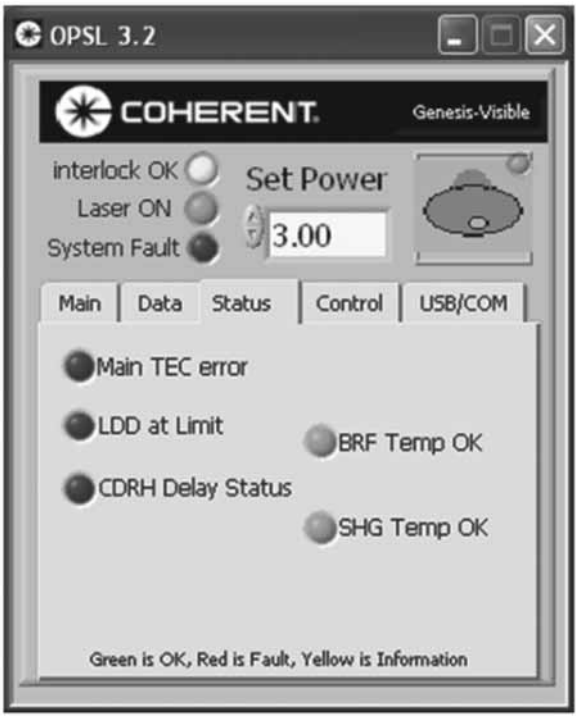
1. Status LEDs
2. Tabs
3. Power Command Window
4. Software Key Status
5. Software Key

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




**STATUS: STATUS INDICATORS FOR DIFFERENT INTERNAL SYSTEMS OF THE LASER. (DIFFERENT INDICATORS WILL BE VISIBLE DEPENDING ON THE LASER TYPE)**

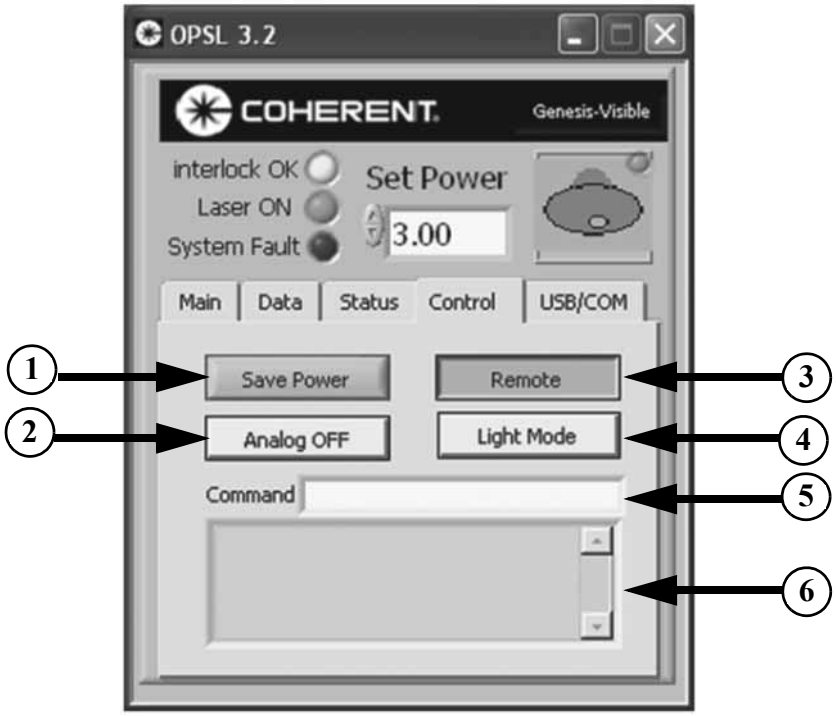
Dark Green = OFF

Light Green = OK

Red = Fault

Yellow = Look for more information using the command window on the control tab.

***Figure 4-1. 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 4-6 IN THE COMMAND FIELD; RESPONSES APPEAR IN THE FIELD BENEATH IT.**

1. Save Power Button. The OEM versions can be configured to operate at a fixed power without need of computer or analog control, this button is used to store the desired power in memory.

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

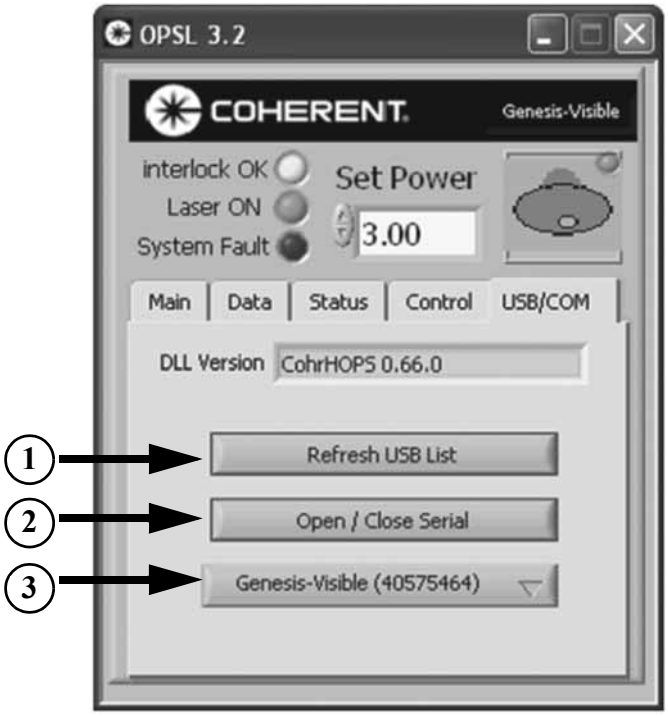
3. Remote/Local Button, changes control between remote and local. Disabled for Low Current OEM (always remote).

4. Light/Current Mode Indicator, changes to desired mode when the proper command is entered into the Command Window.

5. Command Window, use query commands from Table 4-6.

6. Response Window, use Table 4-8 for the key to the binary fault code

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




**USB: FUNCTIONS DEALING WITH THE USB INTERFACE. 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.

1. **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 update the list of lasers to match the lasers actually connected

2. **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.

3. **Laser list pull-down:** The list of lasers connected is displayed as a pull-down menu. The GUI can communicate with one laser at a time. Use the pull-down 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 4-1. 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 4-1. 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 4-2. 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 4-3. CheckForDevices***

| **DECLARATION** | |
|---|---|
| INT32 CheckForDevices(<br>LPDWORD devicesConnected, LPDWORD numberOfDevicesConnected,<br>LPDWORD devicesAdded, LPDWORD numberOfDevicesAdded,<br>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 |
| 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 4-4. 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 4-5. 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 4-6. 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 |
| ?TMAINCMD | Main TEC temperature command | ºC |
| ?TSHGCMD | SHG heater temperature command | ºC |
| ?TBRFCMD | BRF heater temperature command | ºC |
| ?MAIND | Main TEC drive | V |
| ?SHGD | SHG heater drive | V |
| ?BRFD | BRF heater drive | V |
| ?P | Output power measured and computed from photodiode | W |
| ?PCMD<br>PCMD= | Output power setpoint | W |
| ?PMEM<br>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 |
| ?KSWCMD<br>KSWCMD= | keyswitch command: 0=off, 1=on | 0 or 1 |
| ?KSW | keyswitch actual: 0=off, 1=on | 0 or 1 |
| ?INT | Interlock status: 0=not OK, 1=OK | 0 or 1 |

***Table 4-6. 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 | | |
| ?HH | Head hours | hrs. |
| ?CMODECMD<br>CMODECMD= | Photo or current mode command: 1=current mode, 0=photomode | 0 or 1 |
| ?CMODE | Photo or current mode actual: 1=current mode, 0=photomode | 0 or 1 |
| ?ANACMD<br>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<br>REM= | Enable remote control: 0=disabled, 1=enabled | 0 or 1 |

***Table 4-7. 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 4-8. 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 |

## Operation with the MX STM Low Current Controller

### Enable Switch (Low I)

The controller has two independent enable switches:

- Remote enable: pins 6 & 7, interlock connector
- Software switch (closed by default)

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

On initial power up, a fault condition is created and the laser will not turn on. In order to clear the fault one of the enable circuits will need to be cycled off and on again. This can be achieved from either of the two enable switches (remote enable or the software switch)

## Power Command (Low I)

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 values.

1. The controller takes command from two independent sources
   - Software command (USB interface or RS232 serial)
   - Pins 3 & 4 in the interlock connector
2. If pins 8 & 9 are open in the interlock connector, the laser will take command from the software. This is the default condition with the supplied interlock defeat jumper.
3. If pins 8 & 9 are shorted, the laser will take command from sum of the voltage and software commands.

**DANGER!**
**Energy in the mW range may still emit if the sum of the command voltage and software command is zero. To ensure no energy is emitting, set the command voltage so the sum of the command voltage and software command is a negative value. “Analog Control” on page 3-25 for more information on external command voltage.**

**NOTICE!**
**A negative sum voltage will also stop the on-time hour counter.**

.

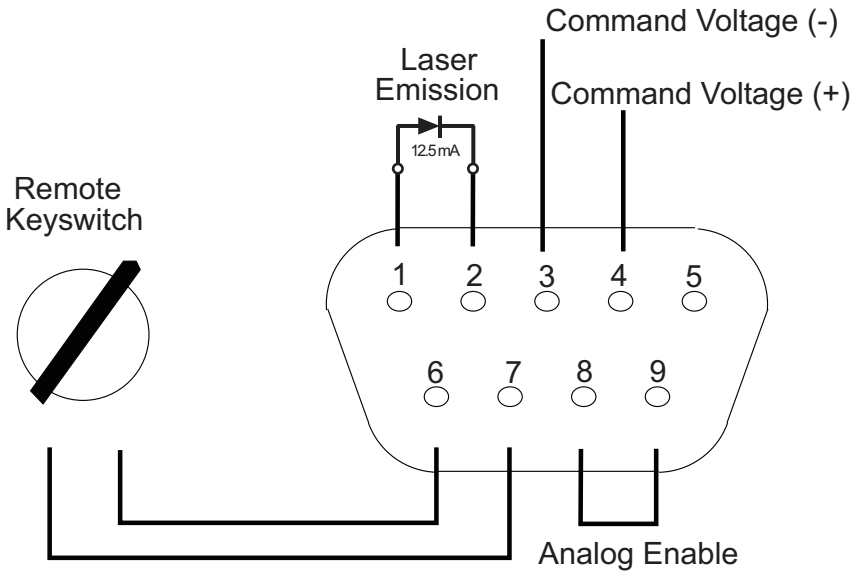



***Figure 4-2. Interlock Connector***

## Controller Panel (Low I)

The controller panel has three LEDs to indicate the status of the laser system

**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 (crystals at temperature, etc)

**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 and if the unsafe situation happens during operation, the error condition latches and it can only be cleared by cycling the enable switch off.

# Operation with the MX MTM High I OEM or Benchtop Power Supply

## Enable switch (High I Models)

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 (High I Models)

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[1]

***Table 4-9. Software Selection***

| SOFTWARE SELECTION | | |
|---|---|---|
| Analog Enable (8 & 9) | Local (default) | Remote |
| Pins Open (default) | Laser takes command from front panel (command = 0 for OEM) | Laser takes command from the USB interface |
| Pins Shorted | Command is sum of front panel (OEM = 0) 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.

1. See "Analog Control" on page 3-25.

## Front Panel Operation (High I Benchtop Power Supply):

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

1. Make sure the shutter is open to allow the beam through.
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.

Note: pushing the control knob in while turning provides coarse adjustment

The command power will reset to zero when the keyswitch is turned off.

## OEM Operation (High I OEM Power Supply)

The OEM Power Supply is controlled via software command or the command voltage through analog control.

1. Make sure the shutter is open to allow the beam through.
2. Turn the keyswitch on the power supply front panel to ON.

Wait 5 seconds. The LASER ON LED will blink during the safety delay period. Low level visible radiation will be emitted at this point.

## LED indicators (High I Models):

The power supply front panel has three LEDs to indicate the status of the laser system, and a keyswitch 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.

# SECTION FIVE: MAINTENANCE AND TROUBLESHOOTING

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

## *Troubleshooting*

***Table 5-1. Troubleshooting***

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| No or low observed emission | Shorting clip connected. | Disconnect shorting clip[1]. |
| | Polarity incorrect.<br>Note: This will likely already have damaged the laser. | Re-check polarity. Refer to "Electrical Installation" on page 3-20. |
| | No power supplied. | Verify power supply operation. |
| | Damaged Genesis™ MX Series. | Return to supplier[2]. |
| Applied voltage exceeds 5 V | Poor electrical contacts. | Improve electrical contact[1]. |
| | Damaged Genesis™ MX Series. | Return to supplier[2]. |
| Optical emission pattern distorted | Dirty optical surface on Genesis™ MX Seriesoutput window. | Clean optical surface with methanol and lens tissue (do not clean with acetone). Refer to procedures titled, "Cleaning the Output Window" on page 5-2. |
| | Damaged optical surface on Genesis™ MX Series output window. | Return to supplier[2]. |

1. Always turn off power supply and use proper grounding procedures before undertaking any mechanical adjustments on the electrical wiring.
2. Contact supplier for authorization prior to returning the unit. If it must be returned to supplier, use the original container for shipping. (See Figure 3-1.) The supplier is not responsible for shipping damage.
   If the laser must be returned, an RMA (Return Material Authorization) number is required.

***Table 5-2. Head Troubleshooting Guide***

| PIN# + | PIN# - | DESCRIPTION | VALUE |
|---|---|---|---|
| 2 | 1 | LBO thermistor | 8-12K ohms |
| 8 | 1 | BRF thermistor | 8-12K ohms |
| case | 1 | | OPEN |
| 9 | 10 | BRF TEC | 1.5-2.5 AC ohms |
| 9 | case | | OPEN |
| 11 | 12 | LBO TEC | 1.5-2.5 AC ohms |
| 11 | case | | OPEN |
| 4 | 5 | Laser Head thermistor | 8-12K ohms |
| 4 | case | | OPEN |
| 7 | 6 | photocell | .570 (diode check) |

## Cleaning the Output Window

Observe the safe handling recommendations given in Section Three while cleaning the optical surface on the output window.

**NOTICE!**
**The following instructions are intended for heads with manual or electro-mechanical shutters without collimators or fiber ports. Removal of the collimator or fiber port will distort the alignment.**

1. Hold a folded piece of lens tissues with hemostats (see Figure 5-1).

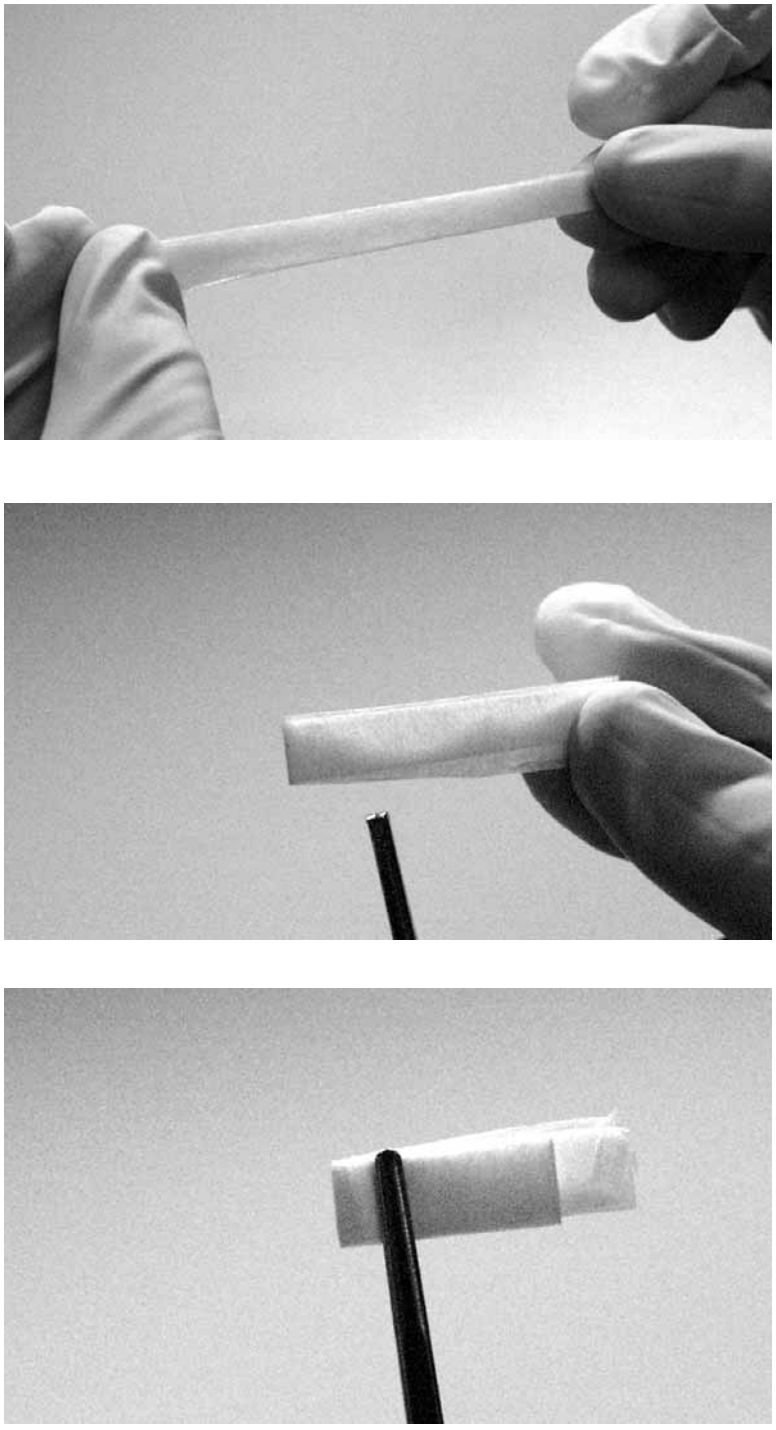


***Figure 5-1. Folding Lens Tissue***

2. Put a drop of methanol on the folded edge of the tissue.

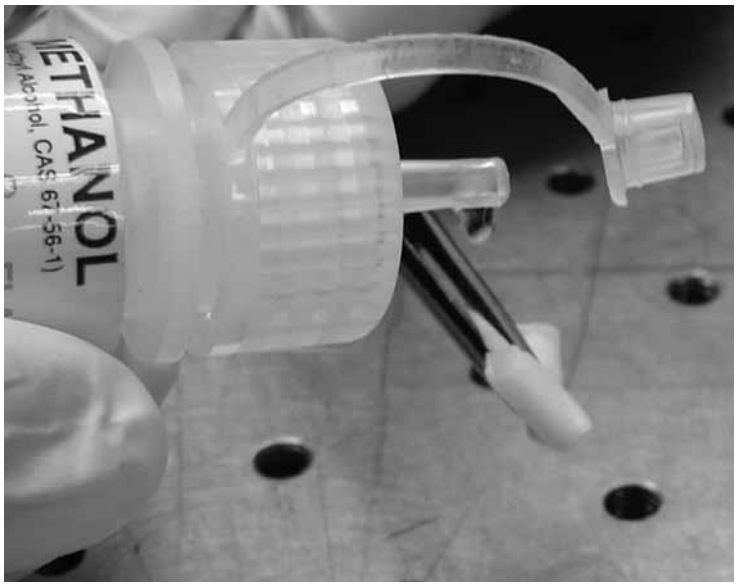



***Figure 5-2. Methanol on Tissue***

3. Place the wet portion of the lens tissue on the surface of the optic near an edge.

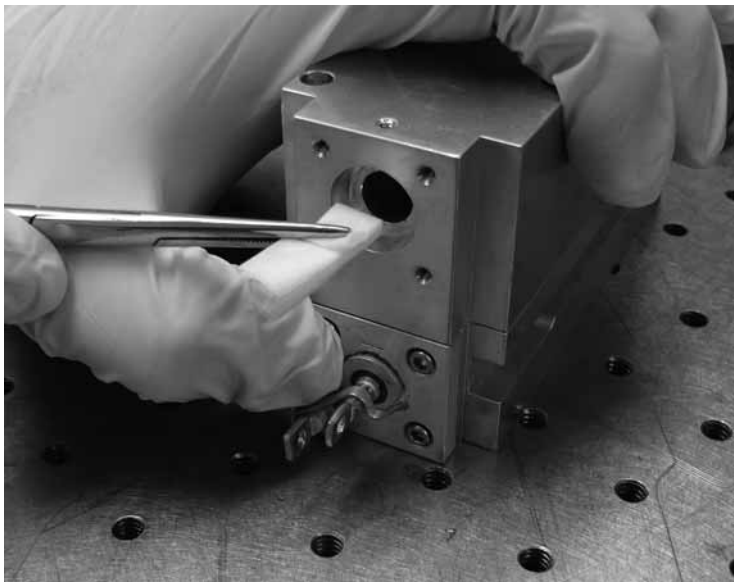


***Figure 5-3. Cleaning the Window***

4. While applying a light pressure, wipe across the entire surface of the optic in one stroke.
5. If streaks or contaminants remain, repeat procedure with another lens tissue. DO NOT USE the same lens tissue.

For details on optics cleaning, view video at:

http://www.coherent.com/Service/index.cfm?fuseaction=forms.page&PageID=40

## *Troubleshooting using Coherent Power Supply LEDs and Software*

Coherent Power Supplies have LED indicators that alerts the users of possible issues. The GUI software used in conjunction with the power supplies also serves as indicators.The following table, spread across two pages aids in determining the issue via LEDs or software, possible causes and solutions and further steps to be taken as necessary.

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**The following table applies only for customers using Coherent power supplies.**

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***Table 5-3. 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<br>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<br>Yellow OFF<br>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<br>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<br>Yellow OFF | OFF Status LED BRF Temp OK or SHG Temp OK |

***Table 5-4. Troubleshooting (Cause/ Solutions)***

| | 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, 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

***Table A-1. Parts List***

| DESCRIPTION | PART NUMBER |
|---|---|
| Genesis™ MX Series Shipping Box | 1141806 |
| Tubing Kit[a] | 1172237 |

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

***Table A-2. Mechanical and Electrical Accessories***

| DESCRIPTION | PART NUMBER |
|---|---|
| Back bias protective diode | IN5817 or equivalent (user-supplied) |
| Insulated #6 ring tongue connector | Panduit PV8-6R, (user-supplied) |
| Heat Sink | 1151117 (Air Cooled)<br>1152410 (Water Cooled) |
| Beam dump | Thor labs: Model BT500, or equivalent (user supplied) |
| Fiber Coupled Option, SMA | 1165511[1] |
| Fiber Coupled Option, FC | 1166113 [1] |
| Air Cooled Option, MTM | 1165502[2] |
| Air Cooled Option, STM | 1166584[2] |
| Water Cooled Option | 1165494[2] |
| Headboard and Cables Kit | 1165701 |
| Electronic Shutter Option | 1202693 |
| Manual Shutter Option | 1151119 |
| Mounting Kit, Genesis MX | 1165499 |
| 1. Fiber coupled with a 50µ core diameter,.22NA fiber. Do not use fibers with smaller cores.<br>2. Comes with Mounting Kit, Genesis MX (1165499) already installed. | |

# APPENDIX B: GENESIS SLM WARM-UP AND ETALON CAPTURE

## *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 keyswitch off.
3. Wait 5 minutes to allow the TEC drive voltage to stabilize.
4. Turn the keyswitch on.
5. Command the power to operating power using the "Set Power" cell on the OPSL software panel.

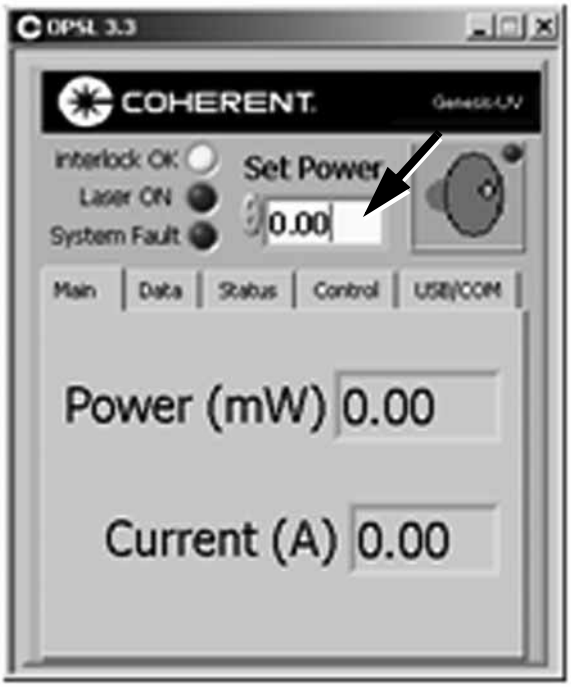



***Figure B-1. "Set Power" Cell***

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 should be repeated after changes to the power set point or excursions in ambient temperature.

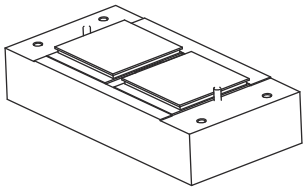
# APPENDIX C: COOLING REQUIREMENTS (FOR USE WITH NON-COHERENT HEATSINKS)

## *Cooling Requirements (for use with non-Coherent heatsinks)*

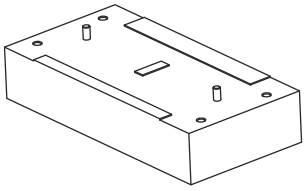
For operation of the Genesis™ MX Series Laser with a user provided heat sink, the following guidelines must be met.

**Thermal Interface**

Ensure that the thermal interface of the heat sink surface completely covers the thermal interface located at the bottom of the laser head. Figure C-1 provides dimensions of the thermal interface and other features required on the heat sink surface.



HEATSINK WITH THERMOELECTRIC COOLERS INSTALLED



HEATSINK TOP FEATURES

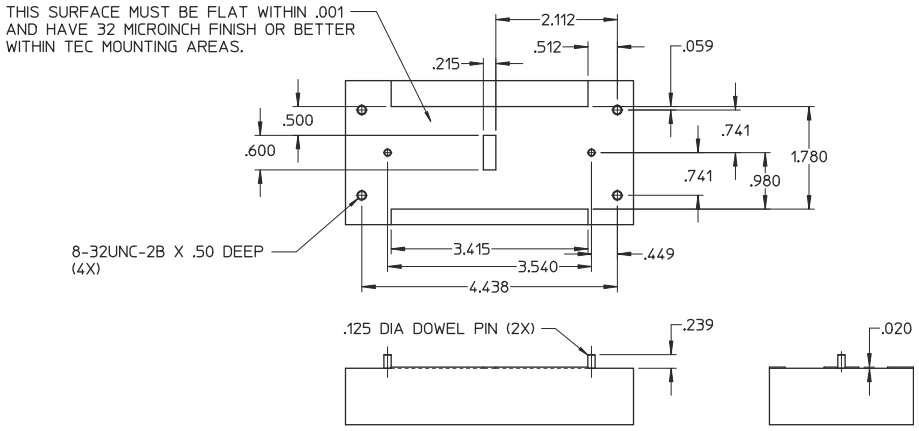



***Figure C-1. Thermal Interface Dimensions***

**Heat sink design guidelines**

The Genesis MX laser system is offered in different power levels, the heat sink requirements vary accordingly. For this discussion we will characterize the heat sink by its thermal impedance (difference in temperature between the hot surface and the environment for every Watt of dissipated power). The maximum thermal load of a given Genesis MX laser head is defined by the maximum diode current. This parameter varies for different MX models and can be obtained from the datasheet or by querying the laser through the

computer interface with the `?CLIM` command. Depending on the power level and capability of the controller used, different TEC can be employed. Only 24V TECs are used for the low current versions. 48V TECs are typically used for the high current version, but if a high efficiency (water cooled) heat sink is available, 24V TECs are preferred because of their lower power needs.

The maximum ambient temperature at which the laser can be operated will differ depending of the heat sink characteristics and the output power of the laser. Use the plot below as a guide to aid in determining the heat sink requirements; it gives the maximum operating temperature as a function of the heat sink thermal impedance for different maximum diode currents. Water cooling is required for some of the higher powered lasers.

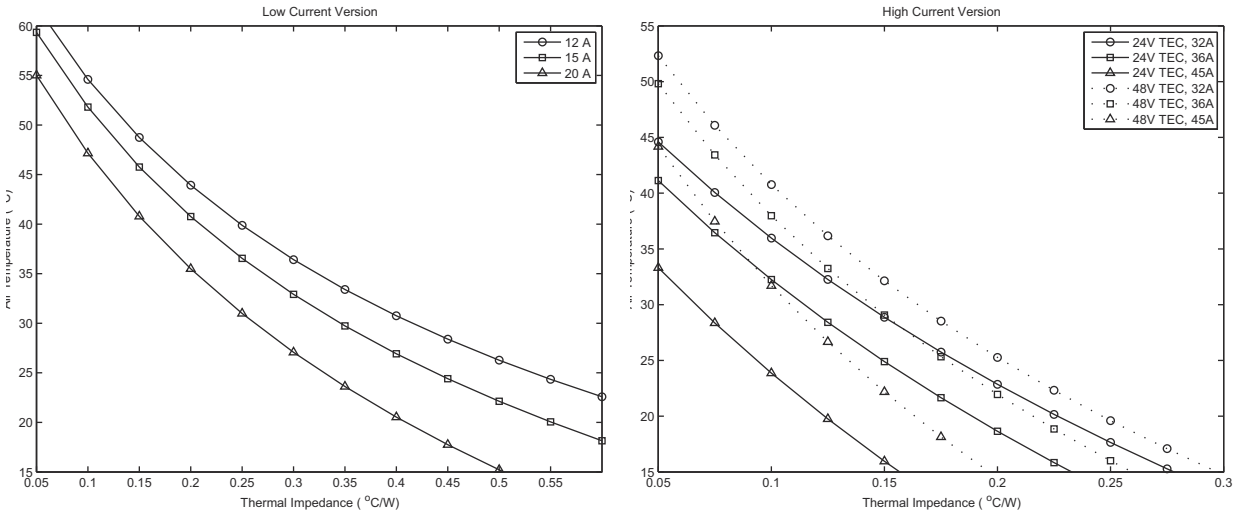



***Figure C-2. Heat Sink Requirements***

Another parameter of interest 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 temperature. The excess heat for normal operating conditions (within the limits of Figure C-2) are given in Figure C-3, that shows the maximum amount of heat deposited on the heat sink when the laser is operated at the maximum temperature (from Figure C-2). In terms of dissipated power, the worst possible situation occurs if the ambient temperature is higher than the limits from Figure C-2. In such case, the excess power will exceed 250W up to the point where temperature control is lost and the internal safeguards turn the laser off.

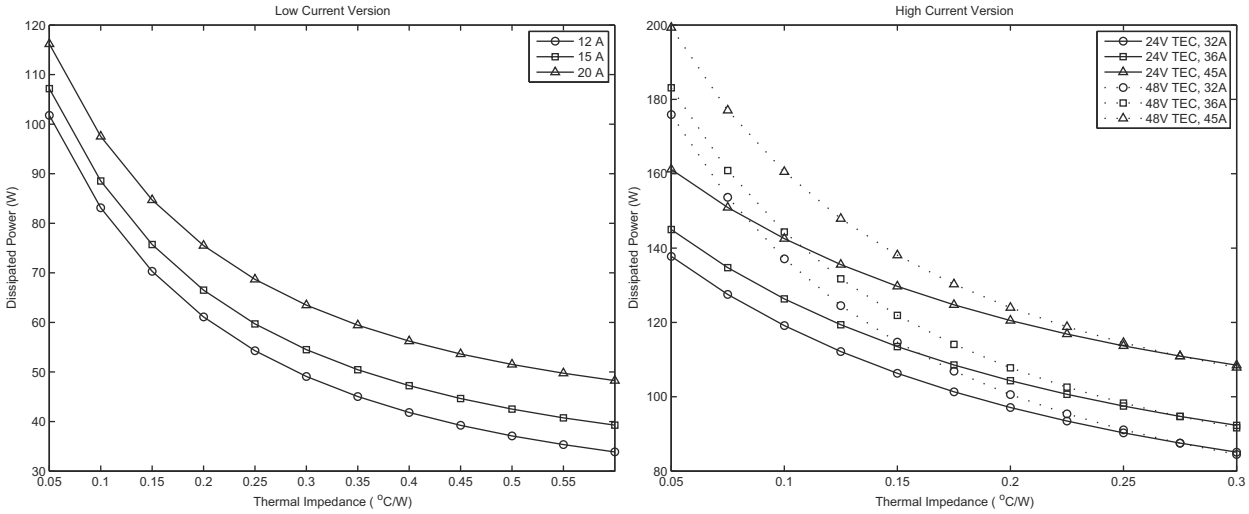



***Figure C-3. Power dissipated in the heat sink***

# WARRANTY

Coherent, Inc. warrants theGenesis™ MX Series 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 ninety (90) days. Extended warranty is available for OEMs certified by Coherent.

## *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 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 |
| µA | Micro ampere(s) |
| µm | Microns |
| $\lambda_o$ | Output wavelength |
| µsec | Microsecond(s) |
| Amp | Amperes |
| cm | Centimeter(s) |
| CDRH | Center for Devices and Radiological Health |
| CW | Continuous wave |
| DC | Direct current |
| ESD | Electro-static discharge |
| g | Gram(s) |
| IR | Infrared |
| m | Meter(s) |
| mm | Millimeter(s) |
| MTM | Multi Transverse Mode |
| mW | Milliwatt(s) |
| N-m | Newton-meter(s) |
| N.A. | Numerical aperture (defined as the sine of the half-angle of the divergence cone that encircles 90% of the energy) |
| Nd:YAG | Neodymium Yttruim Aluminum Garnet |
| Nd:YLF | Neodymium Yttruim lithium Fluoride |
| Nd:$YVO_4$ | Neodymium Gadolinium Orthovanadate (Vanadate) |
| nm | Nanometer(s) |
| OEM | Original equipment manufacturer |
| OPSL | Optically Pumped Semiconductor Laser |
| $P_{cp}$ | Output power |
| RMA | Return material authorization |
| STM | Single Transverse Mode |
| $T_c$ | Case temperature |
| V | Volts |
| W | Watt(s) |

# INDEX

*Operator's Manual Genesis™ MX Series OEM Laser*

*Part No. 1182260, Revision AD*