

DIAMOND C-30+ Air-Cooled OEM Laser

Preinstallation Manual

*Preinstallation Manual
DIAMOND C-30+ Air-Cooled
OEM Laser*



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Bloomfield, CT 06002

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Technical Support

In the U.S.:

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

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

Outside the U.S.:

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

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

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Signal Words and Symbols in This Manual

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

Signal Words

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

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

DANGER!

Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING!

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION!

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

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

NOTICE!

Indicates information considered important, but not hazard-related.

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

Symbols

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



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



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



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



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



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



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

Preface

This is the Preinstallation Manual for the DIAMOND C-30+ Air-Cooled OEM/Industrial carbon dioxide (CO₂) lasers manufactured by Coherent. These lasers are OEM systems; they are designed as components which are to be integrated by the original equipment manufacturer (OEM) prior to delivery to the end user. Coherent strongly recommends that the user read Section One: Laser Safety, before operating the laser.



WARNING!

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

Export Control Laws Compliance

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

Export and re-export of lasers manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations.

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification must be obtained from Coherent or an appropriate U.S. Government agency.

Products manufactured in the European Union, Singapore, Malaysia, Thailand: These commodities, technology, or software are subject to local export regulations and local laws. Diversion contrary to local law is prohibited. The use, sale, re-export, or re-transfer directly or indirectly in any prohibited activities are strictly prohibited.

**Notice
Concerning
Regulatory
Status of
DIAMOND Series
Lasers**

This laser component does not include all safety features that are required by the United States Food and Drug Administration (FDA), Center for Devices and Radiological Health (CDRH) in laser systems sold to end users. It is sold solely to qualified manufacturers who in their end product, supply interlocks, indicators, and other required safety features, in full compliance with 21 CFR 1040, Subchapter J and/or other applicable national and local regulations.

**Notice
Concerning
Warranty**

Operation or handling of this laser component, inconsistent with this manual, may void the warranty.

SECTION ONE: LASER SAFETY

This user information is in compliance with the following standards for Light-Emitting Products IEC 60825-1 / EN 60825-1 “Safety of laser products - Part 1: Equipment classification and requirements” 21 CFR Title 21 Chapter 1, Subchapter J, Part 1040 “Performance standards for light-emitting products”.



WARNING!
LASER RADIATION - AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT!



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

This laser safety section must be reviewed thoroughly prior to operating the C-30+. Safety instructions presented throughout this manual must be followed carefully.

Hazards

Hazards associated with lasers generally fall into the following categories:

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

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

Optical Safety

Laser light, because of its optical qualities, poses safety hazards not associated with light from conventional light sources. The safe use of lasers requires all operators, and everyone near the laser system, to be aware of the dangers involved. Users must be familiar with the instrument and the properties of coherent, intense beams of light.

The safety precautions listed below are to be read and observed by anyone working with or near the laser. At all times, ensure that all personnel who operate, maintain or service the laser are protected from accidental or unnecessary exposure to laser radiation exceeding the accessible emission limits defined in the laser safety standards.



WARNING!

Direct eye contact with the output beam from the laser may cause serious eye injury and possible blindness.

The greatest concern when using a laser is eye safety. In addition to the main beam, there are often many smaller beams present at various angles near the laser system. These beams are formed by specular reflections of the main beam at polished surfaces such as lenses or beamsplitters. While weaker than the main beam, such beams may still be sufficiently intense to cause eye damage.

Laser beams are powerful enough to burn skin, clothing, or combustible materials, even at some distance. They can ignite volatile substances such as alcohol, gasoline, ether, and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers, and photodiodes. The user is advised to follow the control measures below.

Recommended Precautions and Guidelines

1. Observe all safety precautions in this preinstallation manuals.
2. Always wear appropriate eyewear for protection against the specific wavelengths and laser energy being generated. See “Laser Safety Eyewear” on page 1-3. for additional information.
3. Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
4. Stay aware of the laser beam path, particularly when external optics are used to steer the beam.
5. Provide enclosures for beam paths whenever possible.
6. Use appropriate energy-absorbing targets for beam blocking.

7. Block the beam before applying tools such as Allen wrenches or ball drivers to external optics.
8. Limit access to the laser to trained and qualified users who are familiar with laser safety practices. When not in use, lasers should be shut down completely and made off-limits to unauthorized personnel.
9. Terminate the laser beam with a light-absorbing material. Laser light can remain collimated over long distances and therefore presents a potential hazard if not confined. It is good practice to operate the laser in an enclosed room.
10. Post laser warning signs in the area of the laser beam to alert those present.
11. Exercise extreme caution when using solvents in the area of the laser.
12. Never look directly into the laser light source or at scattered laser light from any reflective surface, even when wearing laser safety eyewear. Never sight down the beam.
13. Set up the laser so that the beam height is either well below or well above eye level.
14. Avoid direct exposure to the laser light. Laser beams can easily cause flesh burns or ignite clothing.
15. Advise all those working with or near the laser of these precautions.

Laser Safety Eyewear

Always wear appropriate laser safety eyewear for protection against the specific wavelengths and laser energy being generated. The appropriate eye protection can be calculated as defined in the “EN 207 Personal eye protection equipment - Filters and eye-protectors against laser radiation (laser eye-protectors)”, in other national or international standards (e.g. ANSI, ACGIH, or OSHA) or as defined in national safety requirements. Anyone working with or near the C-30+ laser must wear laser safety eyewear with an OD rating 5 eye protection.



CAUTION!

Laser safety eyewear protects the user from accidental exposure to laser radiation by blocking light at the laser wavelengths. However, laser safety eyewear may also prevent the operator from seeing the beam or the beam spot. Exercise extreme caution even while wearing safety glasses.

Viewing Distance

The C-30+ laser produces optical power levels that are dangerous to the eyes and skin if exposed directly or indirectly. These products must be operated only with proper eye and skin protection at all times. Never view directly emitted or scattered radiation with unprotected eyes. When viewing the laser during operation, the operator must maintain the Nominal Ocular Hazard Distance (NOHD) between the laser or scattered radiation and the operator's eyes. Figure 1-1 summarizes the NOHD for the power range of the C-30+ for direct viewing of the collimated beam along with two other common configurations. The NOHD in Figure 1-1 is based on the Maximum Permissible Exposure (MPE = 0.1 W/cm²) level for each power condition as specified in ANSI Z136.1 and IEC 60825-1.

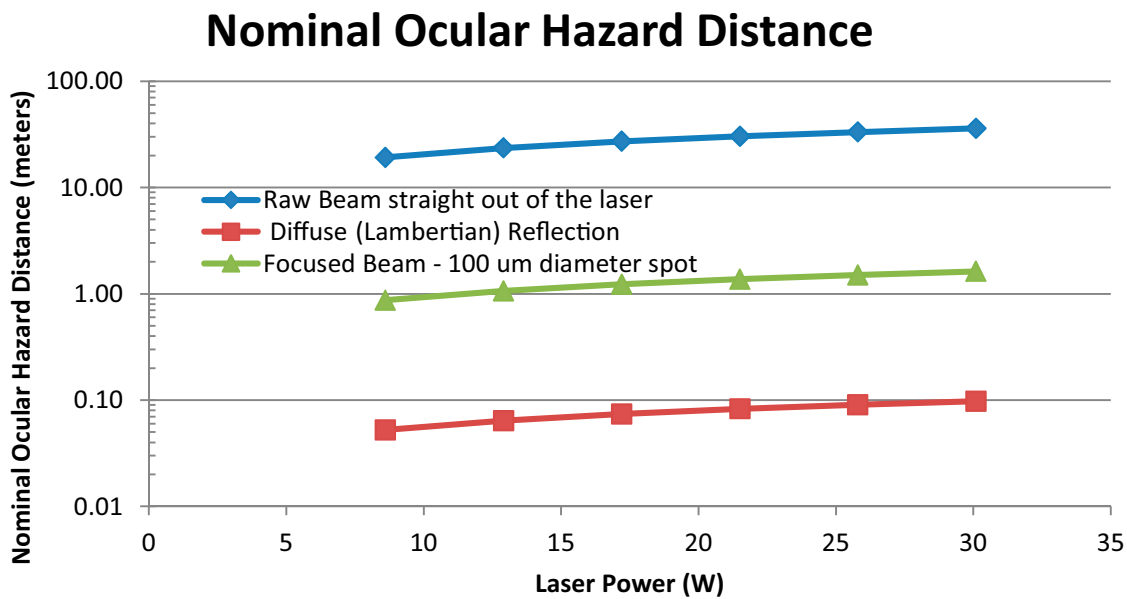


Figure 1-1. Nominal Ocular Hazard Distance (NOHD) for indicated conditions calculated per ANSI Z136.1-2007

Electrical Safety

The C-30+ uses AC and DC voltages. There are no user serviceable components in the laser and integrated RF power supply. All units are designed to be operated as assembled. Warranty will be voided if the laser head is disassembled.



DANGER!

To avoid potentially fatal electrical shock hazards from electrical equipment, follow all applicable electrical codes such as (in the U.S.) the National Electrical Code.

Recommended Precautions and Guidelines



The following precautions must be observed by everyone when working with potentially hazardous electrical circuitry:

DANGER!

When working with electrical power systems, the rules for electrical safety must be strictly followed. Failure to do so could result in the exposure to lethal levels of electricity.

1. Disconnect main power lines before working on any electrical equipment when it is not necessary for the equipment to be operating.
2. Do not short or ground the power supply output. Protection against possible hazards requires proper connection of the ground terminal on the power cable, and an adequate external ground. Check these connections at the time of installation, and periodically thereafter.
3. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who is competent to administer first aid.
4. Always use approved, insulated tools.

When possible, keep one hand away from the equipment to reduce the danger of current flowing through the body if a live circuit is touched accidentally.

Laser Safety Requirements

This laser does not conform to the United States Government requirements for laser safety. In the United States, it is the responsibility of the buyer that the product sold to the end user complies with all laser safety requirements prior to resale. These laser safety requirements are contained in 21 CFR, Sub Chapter J and are administered by the Center for Devices and Radiological Health (CDRH).

Integrators who incorporate the C-30+ lasers into other products that they introduce into United States commerce are defined in the law as manufacturers who are thus required to manufacture their products to conform to the Federal standard, certify them, and submit product reports to the CDRH.

The text of this federal standard is available from the U.S. Government Printing Office Bookstore located in most major cities in the U.S. as well as Washington, D.C. A report detailing how the laser product complies with the Federal standard is required before the product is shipped. The form of this report is covered in a pamphlet entitled: *Compliance Guide for Laser Products*, HHS Publication FDA 86-8260. This pamphlet is available at no cost from:

U.S. Food and Drug Administration
Center for Devices and Radiological Health
Document Mail Center – WO66-G609
10903 New Hampshire Avenue
Silver Spring, MD 20993-0002
www.fda.gov

For jurisdictions outside of the United States, it is the responsibility of the buyer of this laser device to ensure that it meets the local laser safety requirements.

Laser Classification

Governmental standards and requirements specify that the laser must be classified according to the output power or energy and the laser wavelength. The C-30+ is classified as Class 4 based on 21 CFR, Subchapter J, Part 1040, section 1040.10 (c) and/or IEC/EN 60825-1, Clause 5. In this manual, the classification will be referred to as Class 4.

Protective Housing

The laser head is enclosed in a protective housing that prevents human access to radiation in excess of the limits of Class radiation as specified in the 21CFR, Part 1040 Section 1040.10 (f)(1) and EN 60825-1/IEC 60825-1 Clause 6.2 except for the output beam, which is Class 4.

Protective Covers (Safety Interlocks)

The RF power module and laser head covers are not interlocked. These covers should never be removed. There are no user-serviceable components inside.



WARNING!

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



DANGER!

To avoid potentially fatal electrical shock hazards from electrical equipment, follow all applicable electrical codes such as (in the U.S.) the National Electrical Code.

Compliance to Standards Relevant to CE Mark

C-30+ lasers are OEM products, and are sold as components for integration into complete laser systems by a system integrator. These products are tested and CE Marked as independent products. For specific details regarding what applicable compliance directives and standards the products have been tested to, please refer to the Declaration of Conformity which is available upon request from Coherent, per contact information on page ii of this manual.

Compliance to applicable standards for a particular laser tool incorporating C-30+ lasers must be demonstrated by the manufacturer of the complete system. The primary issue for the system integrator is to design covers, shielding, grounding, routing of electrical cable assemblies, and control elements with the proper safety features so that during subsequent testing the system meets the appropriate standards.

Coherent recommends the following guidelines to control the amount of radiated interference:

- Use high quality cables and connectors for all electrical connections
- Verify grounding of cable shields, generally at both ends of the cable

Environmental Compliance

RoHS Compliance

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

Compliance of this laser with the EMC requirements is certified by the CE mark. For more information about the CE mark see “Compliance to Standards Relevant to CE Mark” on page 1-7.

China-RoHS Compliance

Coherent products supplied by Coherent are in conformity with applicable requirements of China's “Management Methods”, commonly referred to as China-RoHS, and associated standards and applies to the production, sale, and import of products in the People's Republic of China.

The China RoHS Hazardous Materials Substance Table is located in the shipping document packet shipped with the product (or laser system).

EU REACH

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

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

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

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

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

Waste Electrical and Electronic Equipment (WEEE)

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU) is represented by a crossed-out garbage container label. The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.

The WEEE Directive applies to this product and any peripherals marked with this symbol. Do not dispose of these products as unsorted municipal waste. Contract the local distributor for procedures for recycling this equipment.

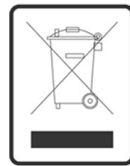


Figure 1-2. Waste Electrical and Electronic Equipment Label

Labeling

Figure 1-3 shows the position of all labels located on the C-30+ laser.

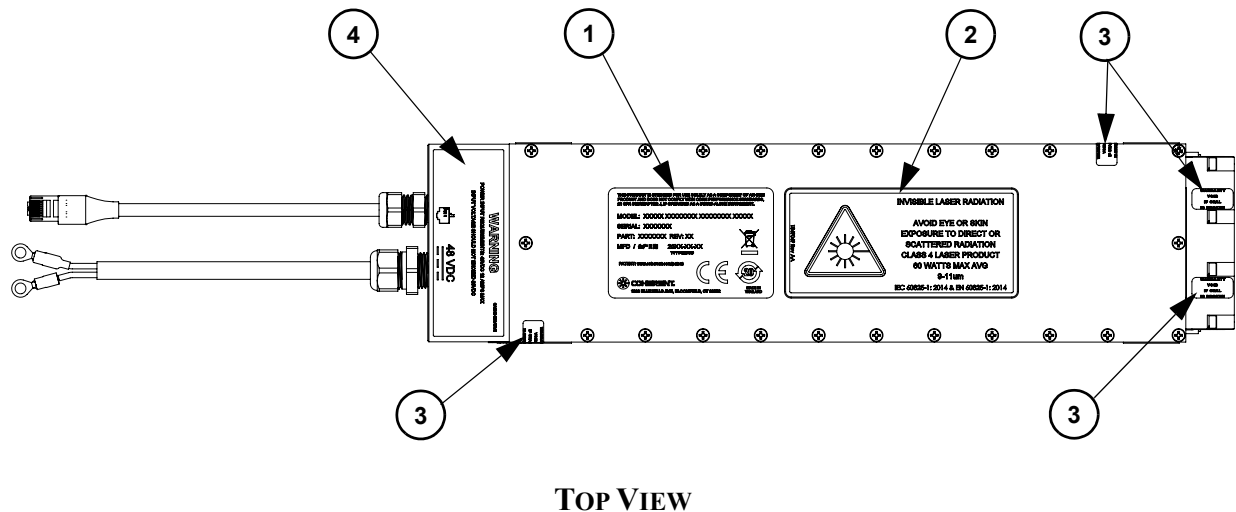
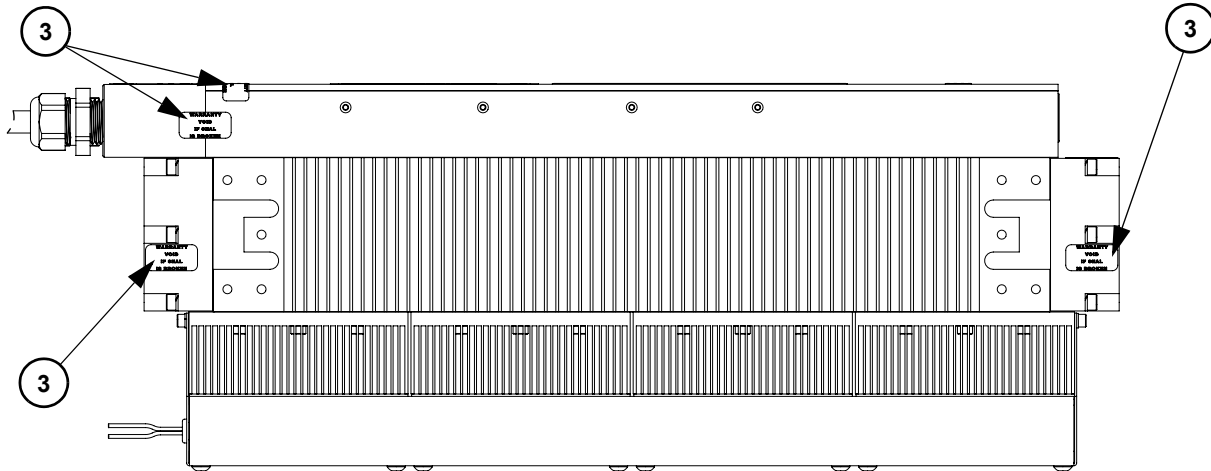
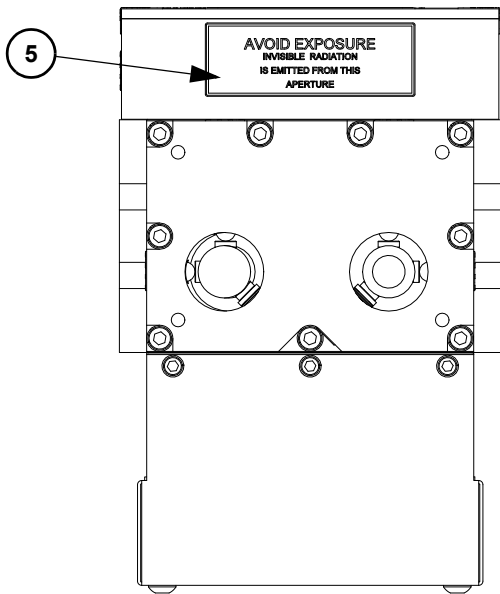


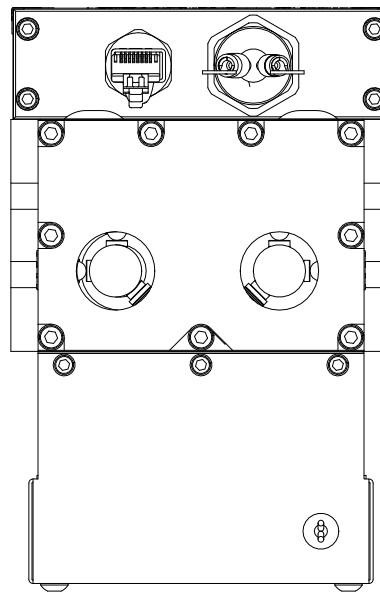
Figure 1-3. Location of Safety Labels (Sheet 1 of 3)



SIDE VIEW



FRONT VIEW



BACK VIEW

THIS PRODUCT IS INTENDED FOR USE SOLELY AS A COMPONENT OF AN OEM PRODUCT AND DOES NOT COMPLY WITH CDRH PERFORMANCE STANDARDS, 21 CFR SUBCHAPTER J, IF OPERATED AS A STAND-ALONE INSTRUMENT.


MODEL: XXXXXX XXXXXX XXXXXX
 XXXXXX XXXXXX



SERIAL: XXXXXXXX


PART: XXXXXXXX REV: XX

MFD / 生产日期 20XX-XX-XX
 YYYY-MM-DD

PATENT: www.coherent.com/patent

 **COHERENT**
 1280 BLUE HILLS AVE, BLOOMFIELD, CT 06002

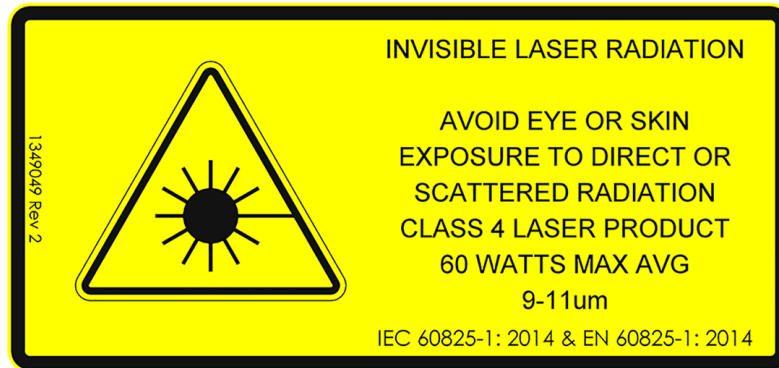
 

 20

MADE IN THAILAND

1. IDENTIFICATION LABEL

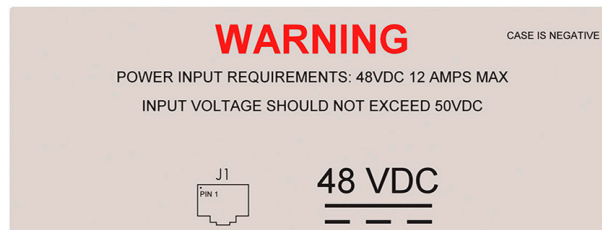
Figure 1-3. Location of Safety Labels (Sheet 2 of 3)



2. DANGER OF LASER RADIATION LABEL



3. TAMPER PROOF LABEL



4. VOLTAGE WARNING LABEL



5. WARNING APERTURE LABEL

Figure 1-3. Location of Safety Labels (Sheet 3 of 3)

Sources of Additional Information

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

Laser Safety Standard

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

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

Publications and Guidelines

International Electrotechnical Commission (IEC)
www.iec.ch

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

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

Equipment and Training

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

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

SECTION TWO: DESCRIPTION AND SPECIFICATIONS

Introduction

In this section, specifications and characteristics of the C-30+ laser will be discussed. Characteristics to be discussed include mechanical, thermal, electrical, and optical interfaces; and environmental requirements and limitations.

The C-30+ laser is a sealed-off, RF-excited CO₂ lasers, capable of continuous wave (CW) or modulated operation. From the laser safety point of view, this laser is considered to be a component and must be integrated into a system by a qualified original equipment manufacturer (OEM) prior to delivery to the end user. See “Laser Safety Requirements” on page 1-6 for a complete discussion of laser safety issues.

Purpose of This Manual

This manual is designed to assist the original equipment manufacturer (OEM) during the integration of the C-30+ OEM laser. It contains information on the performance and operation of the laser as well as installation and control methods.

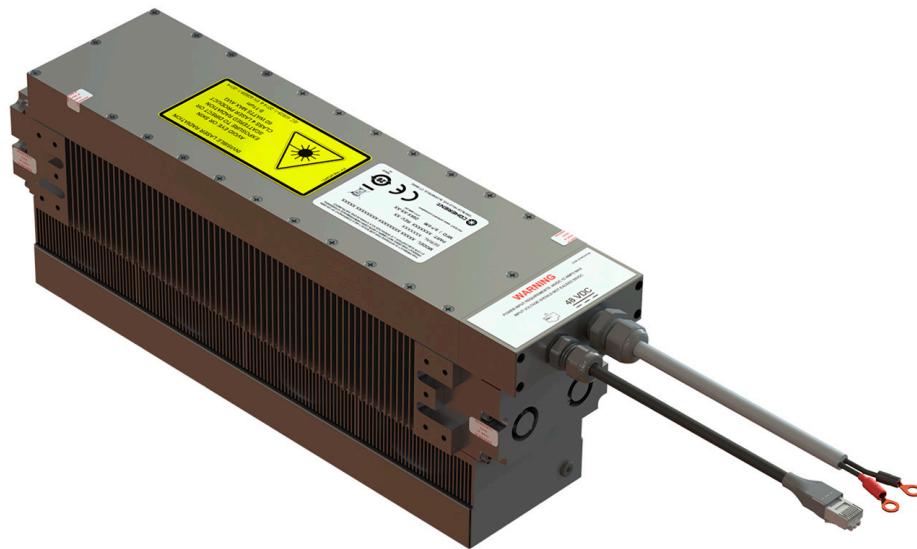


Figure 2-1. C-30+ Air-Cooled Laser

Specifications and Input Requirements

Table 2-2 on page 2-4 provides specifications, configurations, and facility requirements for C-30+ lasers. Refer to the data sheet (available online at www.coherent.com) for power input specifications and requirements.

Figure 2-1 illustrates the baseline configurations (i.e., without any optional hardware additions or deletions) of the C-30+ laser. Each laser system consists of a laser head assembly and an integrated radio frequency (RF) power supply. The RF power module converts 48 VDC, ≤ 11.5 A power to radio frequency power.

Connection of the customer-supplied DC power supply to the C-30+ is via a barrier strip with screw terminals on the RF power module. These terminals should also be used for the connection of wires for remote voltage sensing. Such sensing is recommended to control the voltage at the input to the RF power module more precisely.

Hardware Overview

The C-30+ laser is a waveguide, carbon dioxide (CO₂) lasers. RF electric fields provided by the RF power module excite the CO₂ gas mixture. The standard configuration of these lasers operates at wavelengths between 9 μm and 11 μm in the infrared region of the electromagnetic spectrum.

DC Input Power

DC input power is provided by the user through customer-supplied bus wiring, which goes to the RF power module. The RF power module converts this DC electrical power into RF power, which is used to excite the gas in the laser head. The DC power supply requirements are discussed in detail in the subsection entitled “DC Power Supply Requirements” on page 3-8.

Cooling Requirements

Total heat dissipation for the laser is specified in Table 2-2 on page 2-4. The laser head typically dissipates 325 W from its base surface while the RF power module typically dissipates 175 W for a total typical heat dissipation of 500 W (maximum total heat dissipation is < 575 W). The C-30+ must be provided adequate cooling to keep the laser operating temperature within acceptable limits. The cooling method that is used must not induce stresses that will result in misalignment of the laser resonator. The C-30+ heat sinks are designed so that the assembled structure remains free of excessive stress. Installation requirements related to cooling of the air-cooled version of the C-30+ lasers are discussed in detail in the subsection entitled “Air Cooling” on page 3-6.

Comparison of Air-Cooling & Liquid-Cooling (Reference)

Air-cooling and liquid-cooling each have distinct advantages. Table 2-1 describes the factors to be taken into consideration when choosing a cooling system for a laser module.

Consideration should also be taken if condensable vapors are present and to take suitable measures to purge sensitive areas, such as optical surfaces, with a suitable gas.

Table 2-1. Comparison: The Benefits of Air-Cooling vs. Liquid-Cooling Methods

AIR-COOLING	LIQUID-COOLING
<ul style="list-style-type: none"> • Low in cost • Low in complexity • Low service requirements • Easier to install 	<ul style="list-style-type: none"> • Offers the highest process stability • Can yield the most compact arrangement • Suitable for applications in which the ambient air temperature exceeds 40°C • Better for applications in which the ambient air is laden with particulates • Easier to make a hermetically sealed system



NOTICE!

To avoid damage to the laser, never operate the laser without adequate air cooling.

Laser Head

The laser head takes RF input power and converts some of it to laser radiation. The rest of the RF input power is exhausted as waste heat. For the C-30+ lasers, the waste heat is exhausted into the ambient air. The laser head consists of the folded optical waveguide resonator, the all-metal gas envelope structure, and RF power module. Infrared laser radiation is emitted from the optical aperture. Pictures and dimensional drawings for the C-30+ lasers are shown in Figure 2-1 on page 2-1 and Figure 3-2 on page 3-4.

RF Power Module

The C-30+ RF power module converts DC input power to RF energy, which is sent to the laser head. Heat from the RF power module is exhausted into the surrounding air. An RJ-45-type connector is used to control the laser system. All of the user interfaces (DC power and signal interface) are on one panel of the RF power module.

Specifications, Configuration, and Facility Requirements

Table 2-2 describes the configuration and facility requirements for the C-30+ laser. Laser performance specifications are provided on the data sheet available on line at www.coherent.com and in the test report provided with the laser.

Table 2-2. C-30+ Physical Characteristics

PARAMETER	VALUE
Weight	6.6 kg (14.5 lbs.) Nominal Value
Dimensions LxWxH	372.1 x 92.5 x 139.6 mm (14.65 x 3.64 x 5.5 in.)
IP Rating	IP65
Input Power	
Input Voltage (Measured at input terminal)	48 VDC \pm 2% regulation, < \pm 1% P-P Noise/Ripple
Input DC current	< 11.5 A avg. (18 A peak for 1 ms minimum, measured at input terminals)
Cooling	Air
Heat Dissipation (W)	< 575
Maximum Case Temperature	< 60°C (140°F)
Operating Environment	
Temperature	5°C to 50°C (41°F to 122°F)
Altitude	< 2,000 m (< 6,500 ft.)
Humidity	Non-condensing
Shipping/Storage Environment	- 10°C to 60°C (14°F to 140°F), Non-condensing

SECTION THREE: UTILITY REQUIREMENTS AND SYSTEM INSTALLATION

Introduction

This section covers unpacking and installation of the C-30+ lasers. Detailed operating instructions are given in Section Four: Laser Operation in the operator's manual.

Unpacking and Inspection

Before unpacking the laser components, inspect the shipping carton for evidence of rough handling, and note any damage. If damage to the shipping carton is evident, request the carrier's agent be present when the unit is unpacked. Inform the shipping carrier and Coherent of any evidence of damage in shipment. The buyer and shipping carrier is responsible for any damage which occurs during shipment.

Verifying Delivery

The shipping container contains the following:

- Laser head and integral RF power module
- Final Test Sheet
- Manual packet containing the CD

If any of these items are missing, report this to Coherent immediately.

Protective Shipping Tape

The front of the C-55 laser head is protected by a blue adhesive film or tape (see Figure 3-1). This tape is designed to protect the optics during shipping and must be removed prior to operating the laser.



NOTICE!

To avoid damage, the blue protective tape must be removed BEFORE operating the laser.



Figure 3-1. Protective Shipping Tape

Tape Removal

To remove the protective tape:

1. Pinch one corner of the tape between the thumb and index fingers.
2. Gently pull the tape off of the laser.
3. Discard the tape and do not place the tape anywhere near or on the laser.

Safety Issues in Laser Installation

Installation of the C-30+ lasers must comply with all applicable electrical safety and laser safety laws and regulations. Review Section One: Laser Safety for important information relating to safety.

The negative (return) side of the DC input connection to the C-30+ RF power module is connected internally to the chassis. The user must assure that the system into which the C-30+ is built protects against the possibility that the C-30+ laser head or RF power module chassis could be at a hazardous voltage and that personnel could be exposed to these voltages.



DANGER!

To avoid potentially fatal electrical shock hazards from electrical equipment, follow all applicable electrical codes such as (in the U.S.) the National Electrical Code.

The laser must be secured properly to avoid the possibility of the laser shifting unexpectedly during operation, creating a hazardous condition. The location of the output beam of the C-30+ laser head is shown in Figure 3-2. The laser output is emitted from the aperture shown in the referenced figure and propagates within a full cone angle up to 5°. The acceptance angle of the system aperture must intercept all of the output of the laser.

It is also extremely important to understand the direction, divergence, and magnitude of all reflections that will occur from optical surfaces. Infrared (IR) beams, such as those from the C-30+ lasers, can also be located with commercially available IR screens, such as those produced by Macken Instruments, Inc. [tel. (707) 566-2110]. Coherent recommends that all beam propagation paths be enclosed and that personnel operating the laser be qualified optical technicians who are familiar with this type of hardware.

Mechanical Mounting

The dimensions for the C-30+ laser heads are shown in Figure 3-2. Mechanical mounting of the C-30+ laser head must result in no distortion or stress the laser head in any way. Otherwise, optical alignment and power stability could be adversely affected.

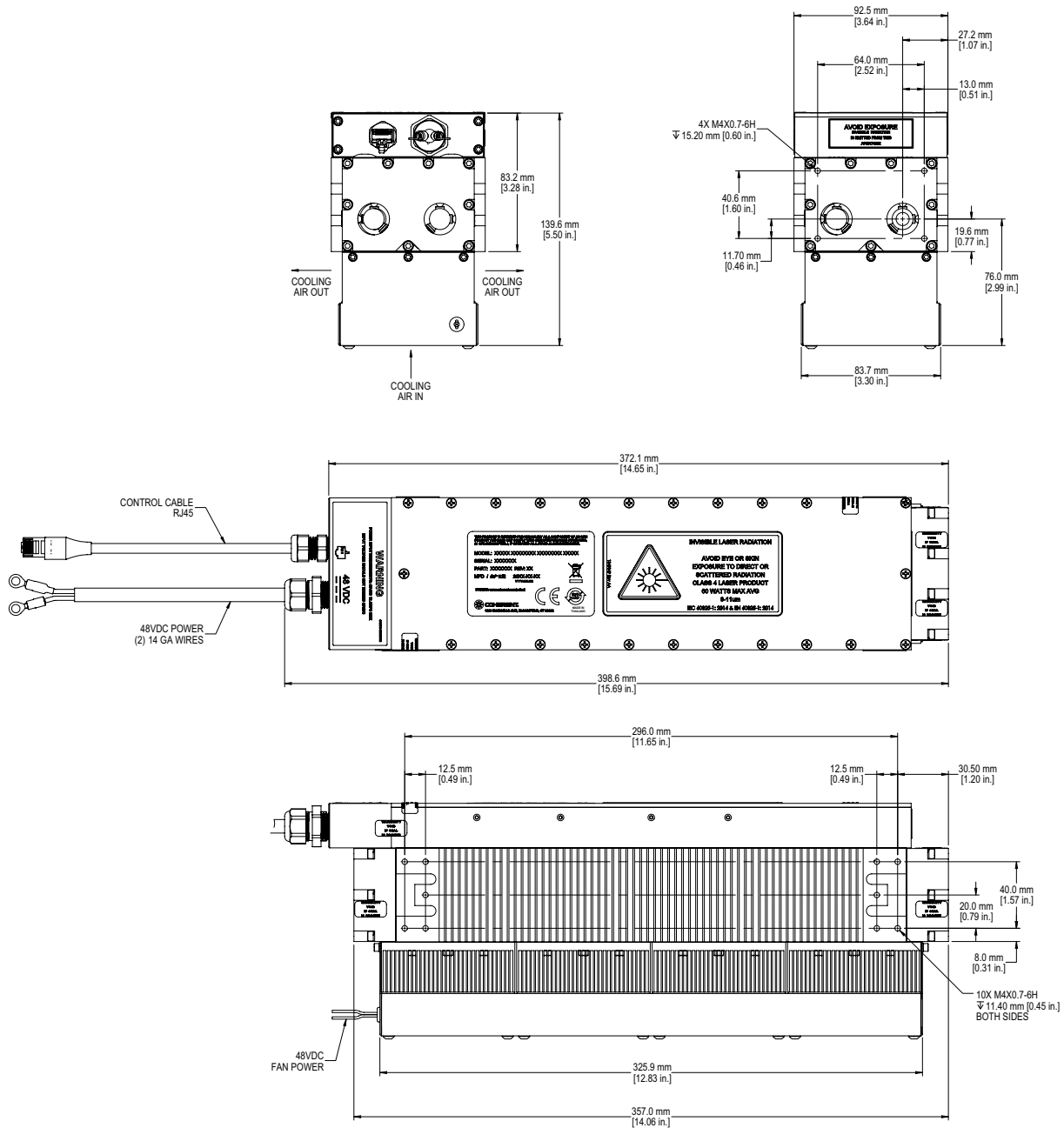


Figure 3-2. C-30+ Air-Cooled Laser Head Dimensions

Mounting Considerations for the C-30+

Certain aspects of specific customer applications may preclude absolute interchangeability of laser heads. For example, for certain applications, the sensitivity of the application to optical beam pointing errors may require external optical realignment after the laser head is replaced in the customer's integrated system. Depending on the method of mounting and the sensitivity of the integrated customer system to beam pointing errors, even removing a laser head from the customer's system, then replacing the same laser head back into the customer's system may require external optical realignment. This external alignment would be a repositioning of the head itself or adjustment of beam delivery mirrors (positions and angle). Consult Coherent if there are any questions about such interchangeability issues.

Coherent recommends use of the optional brackets (part number 1101-12-0016 for a set of 4) that are designed for mounting the laser safely without inducing any stress onto the laser. Care must be taken not to induce stress onto the laser head, as optical mis-alignment of the laser resonator can occur, which would require the laser to be returned to Coherent for service. A mechanical drawing for this bracket is provided in Appendix A. Coherent strongly encourages use of this bracket or a similar design in order to accommodate temperature changes in operation while providing secure mounting.

Ambient Air Cleanliness

Do not turn the laser on if there is water, dust, or dirt on the output element; otherwise, damage to the coating on this optical element may occur. To prevent such optical damage, never allow the output window to become contaminated.

Do not allow the fins on the heat-sinking elements to become clogged with dirt, dust, or debris. They must be cleaned periodically as indicated in Section Five: Maintenance and Troubleshooting in the operator's manual.

The Coherent warranty covers defects in material and workmanship relating to the output optical element, but this warranty does not cover damage to the external output optical surface which is the result of contamination of the surface or abrasion of the surface.

Ingress Protection (IP) Certification

The C-30+ laser has been tested in accordance with IEC 60529, Edition 2.1 *Degrees of Protection Provided by Enclosures*. If required, there are many resources available on the Internet to download a copy of the IEC 60529 standard.

The Ingress Protection rating system shows the degree of protection from both solids and liquids. The first number in this rating system indicates the protection from solids, (typically dust and airborne particulates) for the C-30+ laser. The second digit refers to protection against liquids. The C-30+ has been certified as complying with level IP65 of the standard. The descriptions for IP65 are stated below:

First Digit (6) No ingress of dust: complete protection against contact (dust tight).

Second Digit (5) Protection against low pressure jets of water in all directions for a limited amount of time. Water shall have no harmful effects.

To achieve this rating on the C-30+ laser, the output optical elements were sealed off for the test and no laser light output was present during the test.

Any user wishing to clean the laser with water jets will have to adopt similar precautions or laser warranty will be voided. Coherent is not responsible for damage to the laser caused by not taking adequate steps to protect the laser optical elements, in particular the output window of the laser. The same applies to external optical elements for the machine the laser is integrated into, or any other structural parts of the laser machine such as control electronics, motors, drives, cables and other accessories.

A copy of the report on the testing carried out to qualify this laser at IP65 level is available on request from Coherent.

Air Cooling

The C-30+ air-cooled lasers incorporate heat sinks cooled by forced air (blown by fans). The four fans draw 1 A of current when supplied with the required 48 VDC electrical power. Running the fans at higher voltages will reduce the operating life and is strongly discouraged. The user must provide the correct voltage polarity to the fans in order for the airflow direction and resulting volume to be sufficient to cool the laser adequately.

Air Flow

Open-air flow for the laser system is critical. Therefore, Coherent requires clear access to free air within 60 mm of the cooling fans and fins for the laser system. The air used to cool the C-30+ must be clean and free of contaminants. This requirement can be fulfilled by filtering the air at the input to the laser cavity or system equipment.

If air filtering is not possible, or the environment is dusty, frequent inspection of the fans and heat sinks (depending on the severity of the environment where the laser is located), is strongly recommended. These parts need to be cleaned to maintain adequate laser cooling.

Signal Interface

Coherent uses a temperature interlock to ensure that the fans are operating and supplying sufficient air cooling. It is recommended that both Modulation and Control Enable be commanded to the OFF state when the airflow interlock system detects an over-temperature fault. The system also provides a temperature warning that should be used to alert the user to a need for maintenance of the cooling system to return the performance to the normal full cooling capacity. Failure to take action regarding the temperature warning will result in poorer product performance (outside specifications) and lesser product lifetime. These signals are listed in Table 4-1 on page 4-1 and further discussed in subsections of Section Four: Laser Operation in the operator's manual.

Electrical Power Connection

The C-30+ lasers require 48 VDC input DC power. This power is carried from the power source to the system through the 48 VDC power wires. The maximum current required is 11.5 A, and 18 A peak for 1 ms minimum, measured at input terminals.

The negative (return) side of the DC input connection to the C-30+ RF power module is connected internally to the chassis. The user must assure that the system into which the C-30+ is built protects against the possibility that the C-30+ chassis could be at a hazardous voltage and that personnel could be exposed to these voltages.



DANGER!

To avoid potentially fatal electrical shock hazards from electrical equipment, follow all applicable electrical codes such as (in the U.S.) the National Electrical Code.

Coherent strongly recommends that the user review the precautions described in Section One: Laser Safety regarding electrical safety before using the C-30+ lasers. It is the user's responsibility to provide circuit breakers and/or fusing of the AC power source in accordance with all applicable laws and regulations.

DC Power Supply Requirements

The following are the requirements for the customer-supplied DC power supplies.

DC Voltage:	48 VDC measured at the terminals.
Peak Current:	18 A for a minimum of 1 ms with a maximum voltage drop of 1.5 V
Regulation:	$< \pm 2\%$
Regulation Sensing:	Remote at load
Ripple and Noise:	$< 1\%$ p-p (20 MHz BW limit)
Overload and Short Circuit Protect:	Automatic Recovery

DC Power Supply Cabling Requirements



Coherent recommends the use of remote voltage sense/regulation at the C-30+. This requires a 4-wire cable (2 supply currents and 2 voltage senses).

The following requirement minimizes the voltage loss from supply to the C-30+:

WIRE LENGTH (IN METERS)	AWG
0-2	18
2-3	16
3-5	14
5-8	12
8-12	10
12-20	8

Control Signal Connection

Electrical control of the C-30+ lasers is achieved via an RJ-45 connector built into the system. The signals carried on each of the pins are indicated in Table 4-1 on page 4-1 in the operator's manual. Details about controlling the laser through the signal interface are discussed in Section Four: Laser Operation in the operator's manual.



NOTICE!

Coherent highly recommends use of shielded interface cables. The interface cable shield must connect to the chassis ground of the controller. In addition to proper shielding, this shield provides a secondary connection for the signal ground (Pin 8).

A floating ground connection (use of un-shielded interface cable or no return path between the host control electronics and the laser) can present an unsafe condition and result in unstable or unexpected operation of the laser. This condition can arise when the control signal ground connection (Pin 8) is lost and the Control Enable (Pin 7) and Modulation (Pin 1) remain high. Therefore, Coherent strongly recommends that a second safety ground be provided either via a shielded control cable or common potential chassis mounting between the laser head and the control electronics. Inadequate or nonexistent grounding between the laser and the external control system can result in loss of control of the laser and damage to the laser electronics or the external control electronics.

Beam Propagation

The true waveguide structure of the C-30+ delivers a 1.8 mm $1/e^2$ diameter beam with a 7.5 mrad $1/e^2$ full angle divergence. The typical beam diameter as a function of distance from the laser is shown in Figure 3-3.

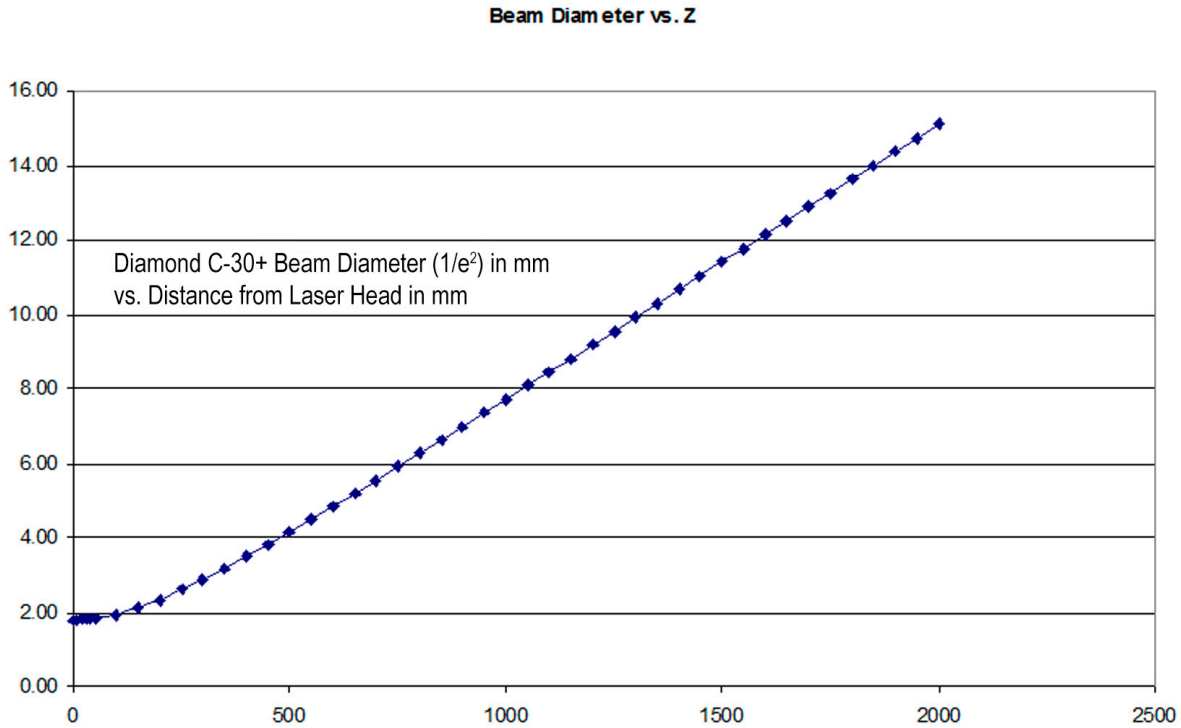


Figure 3-3. Beam Diameter vs. Distance from Laser Head



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