

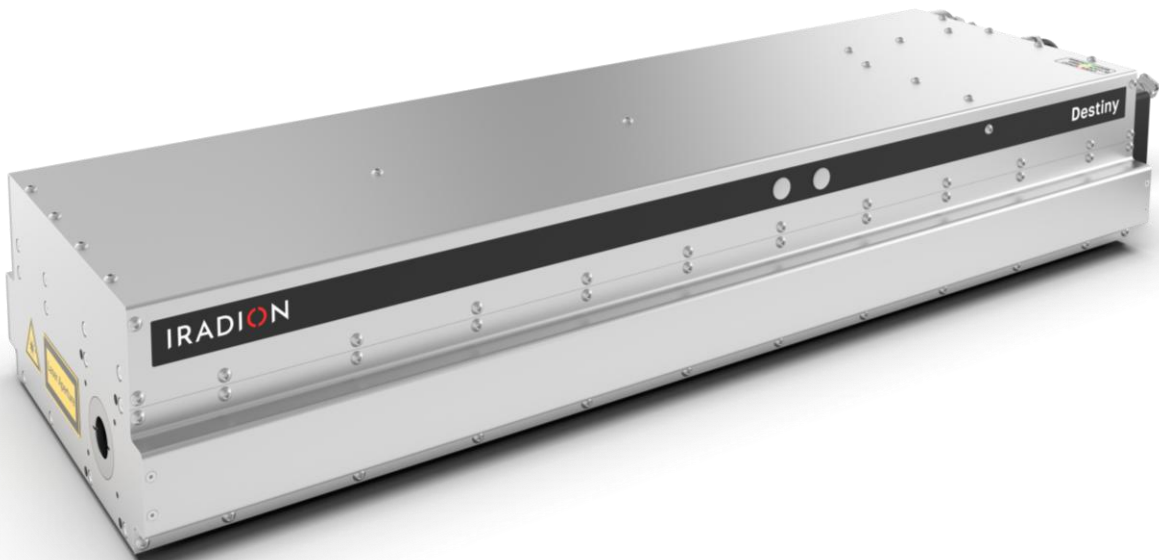
IRADION

CORE LASER TECHNOLOGY

OPERATOR'S MANUAL

Destiny Series

CERAMICORE® CO₂ Laser: Models D200 & D250



<http://www.iradionlaser.com>

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Hazard Information

Hazard information includes terms, symbols, and instructions used either in this manual or on the equipment to alert both operating and service personnel to the recommended precautions in the care, use, and handling of Class 4 laser equipment.

Terms

Certain terms are used throughout the manual or on the equipment labels. Please familiarize yourself with their definitions and significance.



Danger

Imminent hazards which, if not avoided, will result in death or serious injury.



Warning

Potential hazards which, if not avoided, could result in death or serious injury.



Caution

Potential hazards or unsafe practices which, if not avoided, may result in minor or moderate injury.

General Hazards



Danger - Serious Personal Injury

This Class 4 laser product emits invisible infrared laser radiation at 10.6µm.

Do not allow laser radiation to enter the eye by viewing direct or reflected laser energy. CO2 laser radiation can be reflected from metallic objects even though the surface is darkened. Direct or diffuse laser radiation can inflict severe corneal injuries leading to permanent eye damage or blindness. All personnel must wear eye protection suitable for 10.6µm CO2 radiation when in the same area as an exposed laser beam. Eyewear protects against scattered energy but is not intended to protect against direct viewing of the beam.

Never look directly into the laser output aperture or view scattered laser reflections from metallic surfaces even when wearing goggles. Instant blindness can occur.

This laser presents a particular danger due to its very high-power density. The optical intensity at the output window is VERY high (>8500W/cm²).

Enclose the beam path whenever possible. Exposure to direct or diffuse CO2 laser radiation can seriously burn human or animal tissue, which may cause permanent damage

This product is not intended for use in explosive, or potentially explosive, atmospheres.

General Hazards



Warning – Serious Personal Injury

U.S. customers should refer to and follow the laser safety precaution described in the American National Standards Institute (ANSI) Z136.1-2014 document, Safe Use of Lasers. Procedures listed in this Standard include the appointment of a Laser Safety Officer (LSO), Operation of the product in an area of limited access by trained personnel, servicing of equipment only by trained and authorized personnel, and posting of signs warning of the potential hazards.

European customers should appoint a Laser Safety Officer (LSO) who should refer to and follow the laser safety precautions described in EN60825.1-2014 Safety of Laser Products.



Warning – Serious Personal Injury

Materials processing with a laser can generate air contaminants such as vapors, fumes, and/or particles that may be noxious, toxic, or even fatal. Material Safety Data Sheets (MSDS) for materials being processed should be thoroughly evaluated and the adequacy of provisions for fume extraction, filtering, and venting should be carefully considered. Review the following reference for further information: ANSI Z136.1-2014, Safe Use of Lasers



Warning – Serious Personal Injury

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

Other Hazards

The following hazards are typical for this product family when incorporated for intended use: (A) risk of injury when lifting or moving the unit; (B) risk of exposure to hazardous laser energy through unauthorized removal of access panels, doors, or protective barriers; (C) risk of exposure to hazardous laser energy and injury due to failure of personnel to use proper eye protection and/or failure to adhere to applicable laser safety procedures; (D) risk of exposure to hazardous or lethal voltages through unauthorized removal of covers, doors, or access panels; (E) risk of exposure and/or interference from radio-frequency (RF) electro-magnetic energy through unauthorized removal of covers, doors, or access panels; (F) generation of hazardous air contaminants that may be noxious, toxic, or even fatal.

Infinity Series Label Locations

LASE ● ● FAULT
IN' LOCK ● ● TEMP
READY ● ● POWER

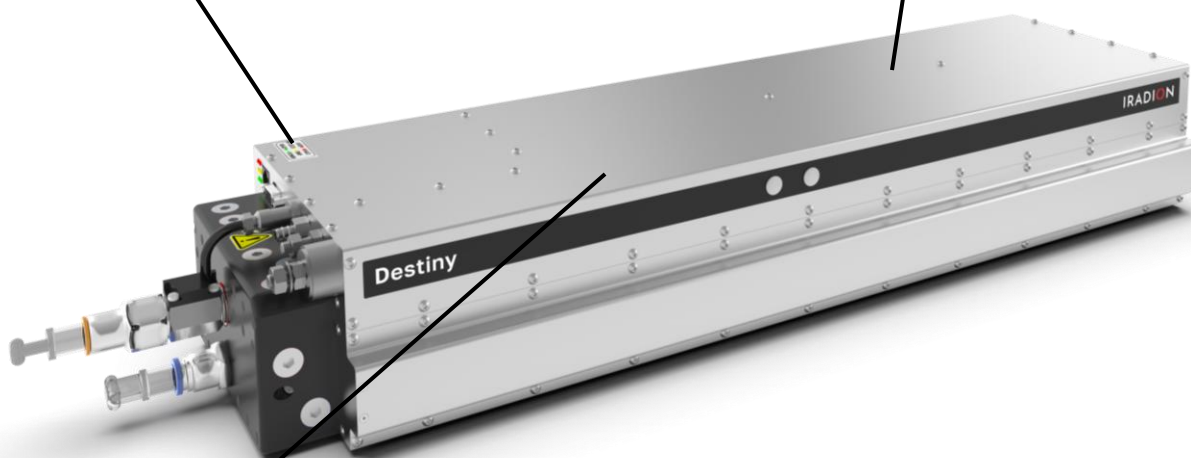
DANGER

**LASER RADIATION - AVOID EYE OR SKIN
EXPOSURE TO DIRECT OR SCATTERED
INVISIBLE RADIATION**



**350W Max
9μm - 12μm**

CLASS IV LASER PRODUCT



This laser is for use as a component only.
It does not comply with standards for
complete laser products specified by
21 CFR 1040 or EN 60825-1:2014

Model# **D250**

Serial # **ABCD024CFA01**



Input Power: **48VDC - 55A**

Output wavelength: **10.6μm**

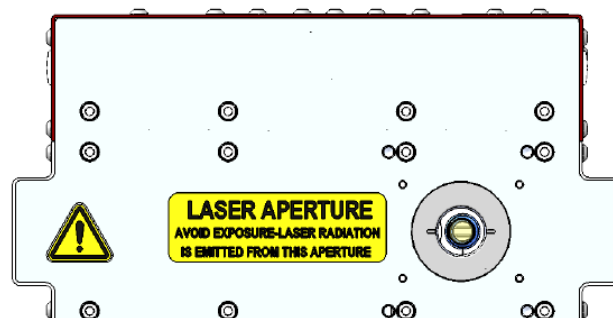
Mfg Date: **07/01/23**

IRADION

CORE LASER TECHNOLOGY

Iradion Laser, Inc.
1 Technology Drive
Uxbridge, MA. 01569

Manufactured under one or more
U.S. Patents 8,422,528, 7,460,577,
8,295,319 and other U.S. and/or
International Patents Pending.



Laser Safety

To prevent exposure to direct or scattered laser radiation, follow all safety precautions specified throughout this manual and exercise safe operating practices per ANSI Z136.1-2014 at all times when actively lasing.

IEC 60825-1
MPE (Maximum Permissible Exposure) = $1.00e-1$
NOHD (Nominal Ocular Hazard Distance) = $1.68e+2$

Always wear approved Laser Safety glasses with a minimum OD (Optical Density) 4.494 for a wavelength of $10.6\mu\text{m}$.

A CO₂ laser is capable of igniting most materials under the proper conditions. Never operate the laser in the presence of flammable or explosive materials, gases, liquids, or vapors.

****NOTICE****

The output aperture comes covered by a clearly marked dust guard that must be removed before use. Firing the laser through the cover **WILL** cause permanent destruction of the laser.



Declaration of Conformity

When integrating Iradion's Infinity Series Lasers, the Buyer and/or integrator of the end system is responsible for meeting all applicable Standards to obtain the CE mark. To aid in this compliance process, Iradion's testing program has demonstrated that Infinity-Series lasers comply with the relevant requirements of 2014/30/EU, the Electromagnetic Compatibility Directive, as summarized in the table below.

Table 1. European Union Directives.

Applicable Standards / Norms

2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive
2015/836/EU	RoHS Directive
EN 61010-1-2019	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements
EN 61000-6-4:2019	Radiated Emissions Group 1, Class A
EN 61000-6-4:2019	Conducted Emissions Group 1, Class A
EN 61000-6-2:2019	Electrostatic Discharge Immunity
EN 61000-6-2:2019	RF Electromagnetic Field Immunity
EN 61000-6-2:2019	Electrical Fast Transient/Burst Immunity
EN 61000-6-2:2019	Conducted RF Disturbances Immunity

After a laser or laser processing system has met the requirements of all applicable EU Directives, the product can bear the official compliance mark of the European Union as a Declaration of Conformity.

After a laser or laser processing system has met the requirements of all applicable EU Directives, the product can bear the official compliance mark of the European Union as shown in the figure below, and a Declaration of Conformity is provided for the compliant component.

Declaration of Conformity

in accordance with ISO / IEC 17050-2:2010

Manufacturer's Name: Iradion Laser, Inc.,
Manufacturer's One Technology Drive
Address: Uxbridge, MA 01569 U.S.A.

Hereby declare under our sole responsibility that the following equipment:

Product Name: **Destiny Series**

Conforms to the following Directive(s) and Standard(s):

Applicable Directive(s):

2014/30/EU Electromagnetic Compatibility Directive

2014/35/EU Low Voltage Directive

2015/836/EU RoHS Directive

Applicable Standard(s):

EN 61010-1:2019 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

EN 60825-1-2:2019 Safety of Laser Products

EN 61000-6-4:2019 Radiated Emissions, Group 1, Class A

EN 61000-6-4:2019 Conducted Emissions, Group 1, Class A

EN 61000-6-2:2019 Electrostatic Discharge Immunity

EN 61000-6-2:2019 RF Electronic Fields Immunity

EN 61000-6-2:2019 Electrical Fast Transient/Burst Immunity

EN 61000-6-2:2019 Conducted RF Disturbances Immunity

*Lasers are not subject to EN 60825-1:2014, *Safety of Laser Products*. Buyers of laser products are solely responsible for meeting applicable Directives and Standards for CE compliance and marking since the final product will itself be subject to this standard.

Corporate Officer:



Philippe Brak, President/CEO



Introduction

This guide provides the basic information needed to operate an Iradion Laser. This laser is designed for use while integrated within a system and is **not designed to meet CDRH requirements as a stand-alone product**. As such, the user must be aware of certain requirements before use.

CDRH

This is an OEM laser component that has been designed for integration into a functioning laser system. As a stand-alone device, it cannot be turned on and therefore does not incorporate all of the safety features required by the Center for Devices and Radiological Health (CDRH). Provisions for the incorporation of these safety features are available, and it is expected that the user will apply them and fully comply with all CDRH requirements.

Available Safety Features

The following safety features are available as electronic signals on the laser's HD-15 control connector:

<i>Interlock</i>	<i>Upon contact closure, allows the system to operate. An open connection will disallow the laser from firing.</i>
<i>Key switch</i>	<i>Upon contact closure, allows the laser to fire after imposing a 5-second delay. (Key switch function is program version dependent.)</i>
<i>Power up in Fault</i>	<i>Requires the key switch to be cycled. (Program version dependent.)</i>
<i>Lase signal</i>	<i>Output signal indicating the laser is firing.</i>
<i>Fault signal</i>	<i>Output signal indicating the malfunction of an internal component or the electronics.</i>
<i>Indicator lights</i>	<i>DC Power, Temp Warning, Interlock, Fault, Ready, Lase</i>

System Overview

This Iradion laser is a waveguide laser with a “slab” unstable optical resonator. The beam is corrected by a patented internal correction scheme to generate a nearly round beam.

The Iradion D200 CO₂ laser is rated at 200W and the D250 is rated at 250W. These lasers include an integrated RFPA and separate power supply/air supply in 2 packages. Connectors in the rear provide the interface to control signals, power, water, air and returns diagnostic signals and faults signals. Connector pins and associated electronics are protected against static ESD damage. DC power and filtered air is supplied from a separate unit designed to maintain the proper voltage, current and airflow to avoid system faults.

Because this laser is small with a low thermal mass, it becomes overheated internally in only 60 seconds without cooling. Although it does have a thermal protect function, these lasers depend on the flow of water to stay cool. For that reason, the D200/D250 monitors the actual flow rate of water and will fault below or above specified limits. **(See section on cooling.)**

The D200/D250 also includes airflow monitoring and will fault if the airflow is too high or low. Because the exact regulation of house air can be difficult, the D200/D250 comes with a specially configured air pump and filters. Internal sensor settings ensure that the laser will operate without faults when fed from this pump. **This laser will not operate without an air source. (See section on air flow.)**

The D200/D250 also includes an RS232 interface to allow monitoring of the settings and flows. Iradion can provide a special Windows™ based application that reports parameters including water and air flow as well as the voltage, temperature, fault codes, serial number and other parameters.

This Iradion laser is class IV laser product that can burn skin, start fires and generate smoke. Proper smoke evacuation may be required. A proper target or backstop must be provided. **This model can exceed 300 Watts of power under normal operation.**



Caution

There are no user serviceable parts under the cover. Removal of the RF cover must be done according to a procedure or damage could occur. (The RF cover edges are RF sealed to the top heat sink, which makes it very difficult to slide off the cover.) The laser may not operate properly without the cover in place. There are dangerous RF voltages under the cover that will cause serious RF burns to skin if touched.



Caution

There are no user serviceable parts in the AC Power Supply.

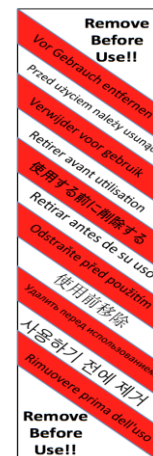


Caution

The optical intensity at the output window is **VERY** high ($>8500\text{W}/\text{cm}^2$). Any contamination to the window surface could cause runaway destruction. To protect the window, Iradion provides a power supply unit that includes a long-life air pump and filters to bathe the window in clean filtered air. Do NOT burn materials close to the laser. The flow of air may not be enough to overcome the explosive vaporization of objects near the output aperture.

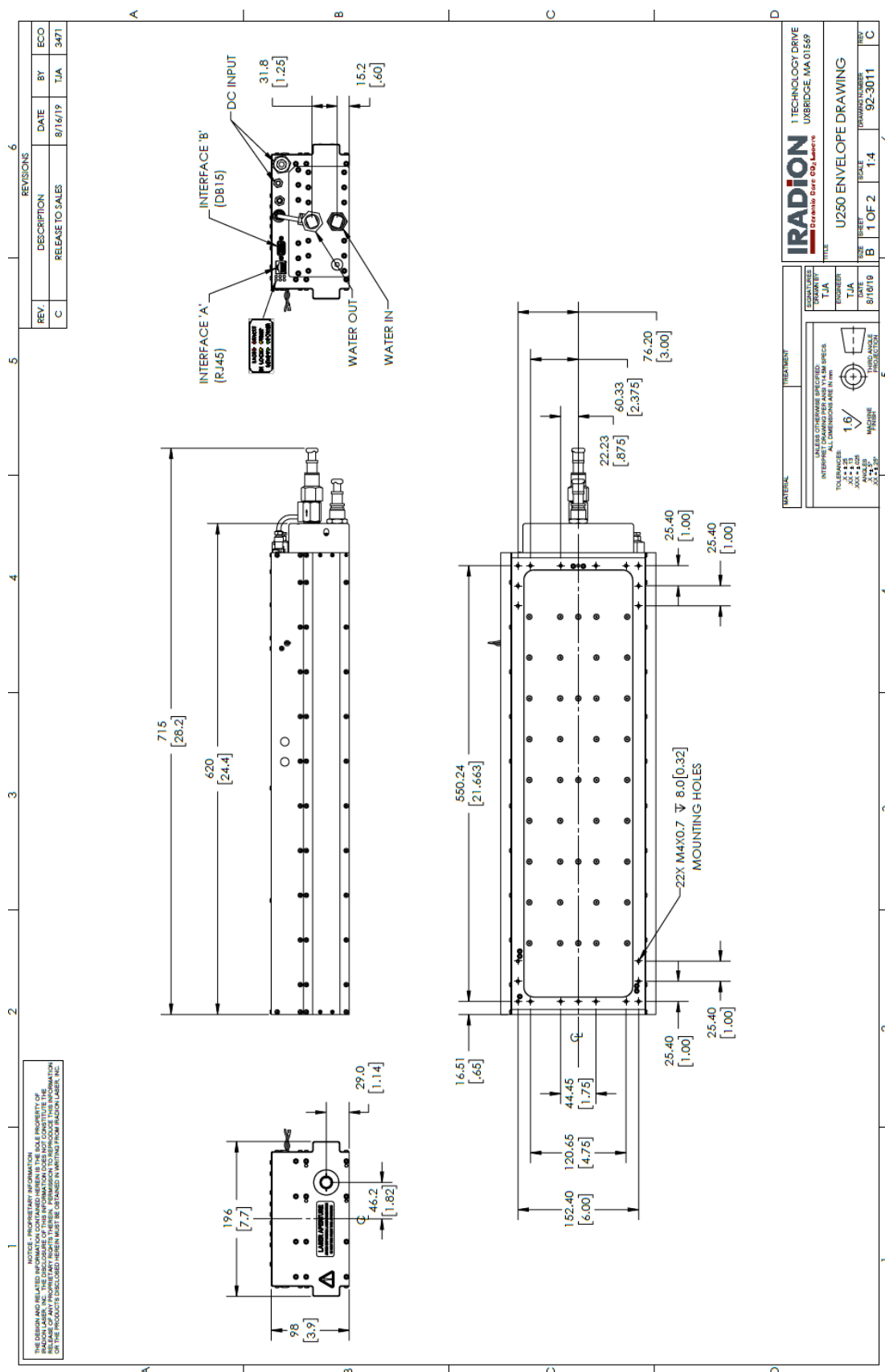
****NOTICE****

The output aperture comes covered by a clearly marked dust guard that must be removed before use. Firing the laser through the cover **WILL** cause permanent destruction of the laser.



THE FOLLOWING SECTIONS MUST BE REVIEWED BEFORE ANY ATTEMPT IS MADE TO POWER UP THE UNIT!

Technical Drawings

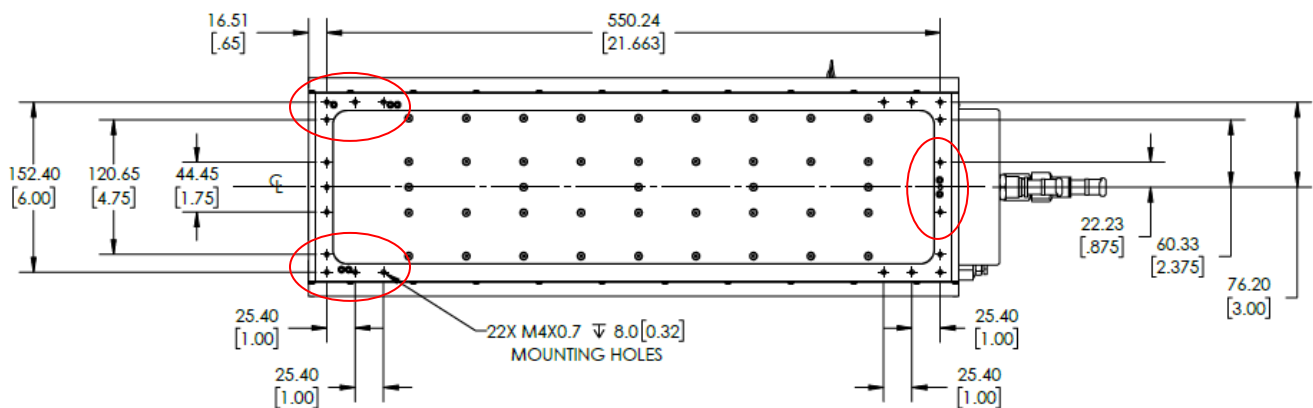


Mounting

On the bottom of the laser there are 22 mounting holes provided (4mm x 9mm deep).

The laser must be mounted on three (3) points so that no stress is imparted to the structure. The mounting holes are provided so the user can select 3 holes or 3 sets of holes to attach mounting pads. The mounting pads must create a minimal space under the laser.

The simplest mounting would be with three (3) spherical washers using two (2) of the holes in the front corners and one (1) in the center rear. For increased mounting strength, a cluster of three or four holes in a corner can be used to attach a mounting bracket of the user's design. Three of these mounting brackets would make up the 3-point mounting. This might be a better solution for situations in which the laser is mounted to a gantry that imparts accelerations to the laser with associated high stresses at the mounting points.



Specifications

Destiny

Model	D200	D250
Nominal Power	200 W	250 W
Beam Quality	$M^2 \leq 1.2$	$M^2 \leq 1.2$
Beam Ellipticity	$< 1.2:1$	$< 1.2:1$
Beam Diameter, $1/e^2$ @ 0 m	2.5 ± 0.5 mm	2.5 ± 0.5 mm
Beam Divergence (full angle)	6 ± 1 mrad	6 ± 1 mrad
Wavelength	10.6 μ m, 10.2 μ m	10.6 μ m, 10.2 μ m
Fall Time	< 75 μ s	< 75 μ s
Power Stability*, Water	$\pm 4\%$	$\pm 4\%$
Polarization	Linear (Parallel to mounting plate)	Linear (Parallel to mounting plate)
Cooling	Water	Water
Input power / Heat Load	2340 W	2640 W
Input Voltage, Current	45 V / 52 A	48 V / 55 A
Frequency Range	0.1 - 140 kHz	0.1 - 140 kHz
Operating Temperature	5 °C - 40 °C / 40 °F - 104 °F	5 °C - 40 °C / 40 °F - 104 °F
Operating Humidity	Non-Condensing	Non-Condensing
Shipping Temperature	-10 °C - 60 °C / 14 °F - 140 °F	-10 °C - 60 °C / 14 °F - 140 °F
Weight	24.6 kg / 52 lbs.	24.6 kg / 52 lbs.
Dimensions L x W x H	684 x 196 mm x 99 mm	684 x 196 mm x 99 mm

Nominal Power: Power Measured at 25 °C and may derate up to 1% per 1 °C for higher laser head temperatures.

Power Stability: Stability test was conducted at rated voltage and rated power, $\pm (P_{max}-P_{min}) / (P_{max}+P_{min})$ after the laser warm up period of (5 minutes).

Iradion follows a policy of continuous product improvement. All specifications are subject to change without notice. Rev. 1.1, 10/2025.

Electrical Connections, Laser

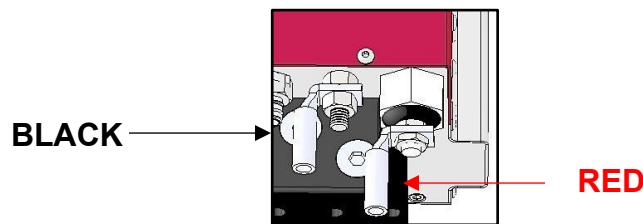
There are two signal connectors and two power terminals on the rear of the laser available for operation of the laser. The 15 pin “D” connector contains all the available connections for operation. The RJ-45 connector contains a basic set of connections.

Power Cable Connections

Designation	Description	Comment
Black	Power Ground	6-gauge welding wire
Red	Power VDC positive connection	6-gauge welding wire

Screw torque should equal 3 Nm.

**DO NOT ROTATE THE CONNECTOR'S MAIN MOUNTING NUT
AS INTERNAL DAMAGE MAY OCCUR.**



Connector (HD-15 pin “D”) *

*The use of standard Video cables with a HD 15 pin connector is not permitted when interfacing to this connector.

Designation	Pin	Description	Comment
HD-15 Pin	1	CTL TXD	RS 232 Transmit.
HD-15 Pin	2	CTL RXD	RS 232 Receive.
HD-15 Pin	3	Modulation Low In	This line grounded or driven independently for command line isolation. (Page 19)
HD-15 Pin	4	Modulation High In*	TTL signal relative to pin 3. (Page19)
HD-15 Pin	5	Ready LED Drive	Signal to drive an LED directly with grounded cathode. 5V @ 33mA, 150Ω series resistor.
HD-15 Pin	6	Key Switch in	Ground this line through key switch to arm laser.
HD-15 Pin	7	Fault LED drive pin	Signal to drive an LED directly with grounded cathode. 5V @ 33mA, 150Ω series resistor.
HD-15 Pin	8	Forward Monitor Out 1	Signal use optional.
HD-15 Pin	9	Reflected Monitor Out 1	Signal use optional.
HD-15 Pin	10	Forward Monitor Out 2	Signal use optional.
HD-15 Pin	11	Lase LED drive pin	Signal to drive an LED directly with grounded cathode. 5V @ 33mA, 150Ω series resistor.
HD-15 Pin	12	Reflected Monitor Out 2	Signal use optional.
HD-15 Pin	13	Interlock signal	Ground this line through switch to enable laser.
HD-15 Pin	14	Ground	System Ground.
HD-15 Pin	15	Temperature Warning LED drive pin	Signal to drive an LED directly with grounded cathode. 5V @ 33mA, 150Ω series resistor.

Connector (RJ-45)

RJ-45	1	Modulation High in	TTL relative to GND or Pin 6. (Page 19)
RJ-45	2	Fault LED drive pin	Grounded Cathode
RJ-45	3	Interlock	Grounded Interlock will enable laser.
RJ-45	4	CTL TXD	RS232 Comm line
RJ-45	5	CTL RXD	RS232 Comm line
RJ-45	6	Modulation low in	This line grounded or driven independently for command line isolation. (Page 19)
RJ-45	7	Ground	System GND
RJ-45	8	Ground	System GND

Note: This unit is provided with a 1-meter length of 6-gauge welding cable for DC power. If the wire is extended in length, it must be of 6 gauge or heavier and must be able to carry 60 Amps with no more than 0.5 Volts drop. Avoid adding more than 1 meter of additional wire unless it is heavier than #6. This laser is provided with prewired power supplies that are set to 48 Volts. Do not attempt to adjust the voltage of either power supply! No damage can occur to the laser if the DC voltage is in the range of 0 to 48 Volts; however, the laser will operate only at the specified voltage. The software will allow for -2/+1.5 Voltage variation including line drops at high current settings. **If output becomes intermittent and the fault lamp flashes on and off, the voltage drop on the power cable may be too large or the power supply connections may be bad. If the fault lamp lights up on power up, check the power supply voltage.**

“W” Type Lasers

Water cooled lasers require ½ **inch** plastic hose water connections before operation. See **“Other Connection Details”** below. D200/D250 water cooled lasers detect water flow. If the laser is operated without water flow or if the laser is not receiving enough water, a fault will occur (see fault light chart). If the flow is too high, the pressure may exceed the maximum limit of 60 psi and a fault will occur. Flow rates exceeding 4 gallons/min. are not recommended or needed. If the water flow becomes too high or too low, there will be a 10 second delay before the water fault occurs. See the Iradion LCC Comm Protocol_v2.0 for information on communicating with the laser control card.

Operation of Unit

1. Mount the laser in a manner such that the beam will strike a target capable of absorbing >300 watts of power. Make sure that the aperture is clear of obstruction. See pages 14 and 15 for the power supply connections. **Remove the aperture cover.**
2. Confirm that the signal connections to the laser are secure and tight. Make sure that the power supply unit is correctly connected, including the blue air hose. Make sure the inner desiccant and outer air filters are in place. (The desiccant filter must be changed every 300 to 700 hours of operation depending on the humidity.) Make sure that the water connections are in place and the water flow direction is correct.
3. Connect the laser power leads to power supply terminals, Red (+) and Black (-) using at least 6-gauge wire. Be careful not to over-tighten the 7/16" bolt on the (+) connection at the laser. This connection is part of an RF feed-through filter and can be damaged.
4. Make sure the "INTERLOCK" is off or the interlock line is ungrounded.
5. Start the water flow. Make sure that the water is flowing out of the flow turbine assembly.
6. Power up the DC supply. Check that the fault light is off and the ready light is on. **Wait 20 seconds.** If the ready light is still on after 20 seconds, then the air and water flow is within the proper range.
7. If the Key Switch function is enabled, this line must be toggled from off to on to arm the laser. If the switch is closed when power is applied, then turn it off and then on. There will be a 6 second delay before the green "READY" light lights. **This switch must be toggled to arm the system after power up. (NOTE: This function depends on the software version and programing. OEM lasers are shipped without this function.)**
8. When the system arms to "READY" and the interlock line is closed, the "LASE" light might also light faintly if the tickle is being applied. The "LASE" light will get brighter as the power (PWM duty) increases. This is normal.
 - If a tickle signal is being used, the "Modulation Hi" connection to the laser requires that the command signal contain a tickle pulse of 1 to 3 μ S at 5,000 Hz when the laser is not being commanded to fire. The laser control card can be programed to stretch incoming pulses up to 10 μ S. This allows the tickle signal to be adjusted to just under the threshold of lasing. **(See Tickle Pulse section)** Tickle rates of greater than 5,000 Hz will result in dangerous conditions (possible unexpected low-level emissions). When the laser is being commanded, the modulation rate can be up to 150 KHz. **(NOTE: OEM lasers are shipped with the pulse stretch function disabled. In this case, the user must provide the correct tickle protocol at all times.)**
 - Make sure there is enough water-cooling capacity available to dump the heat. The D250 requires a water chiller capable of cooling a 3000-Watt load.

Temperature vs. Performance

Temperature control is vital to achieving peak performance and longevity in sealed RF-driven CO₂ lasers. These lasers perform best at 20–25°C (68–77°F) with clean, dry airflow. Even a slight temperature rise reduces power typically 0.5–1% for every 1°C above 25°C. A 10°C increase can reduce output by 5–10%, slowing cutting or engraving speeds and increasing the risk of thermal shutdowns. Excess heat also accelerates wear on RF electronics and seals, with just a 10°C rise potentially halving component life expectancy.

This temperature-performance behavior is fundamentally physics-based, not a design flaw or quality issue. All sealed CO₂ lasers, regardless of brand, are governed by the same principles of gas excitation and optical resonance, and therefore all experience similar thermal effects. The causes—gas heating, resonator expansion, and RF electronics drift—are universal and unavoidable.

Key message for customers: Maintaining a cool, clean, and well-monitored environment is the most effective way to preserve full rated power, ensure consistent throughput, and extend laser lifespan.

Tickle Pulse

This option is supplied by the customer, Iradion **DOES NOT** supply the tickle pulse inside the laser.

Laser Command Signals

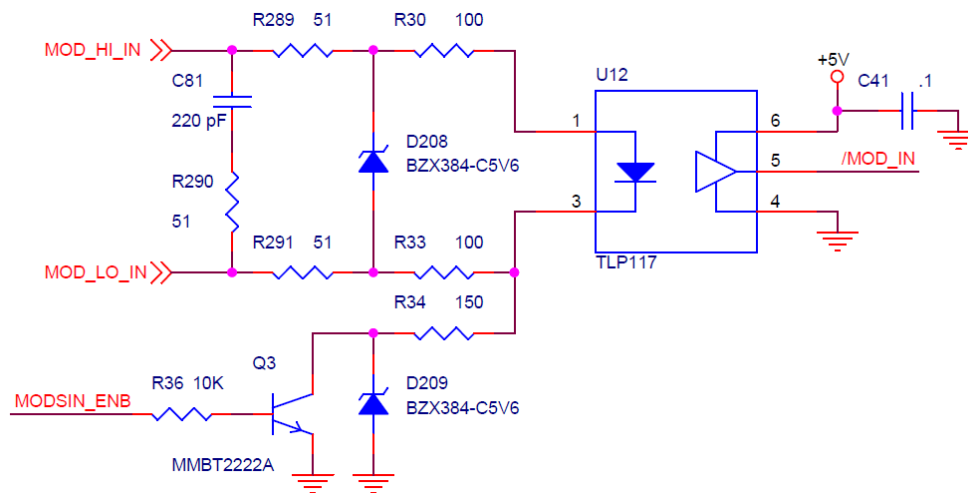
During laser bench testing, it is recommended that command signals be generated from an Iradion Laser Controller or a properly programed pulse generator. These units can provide the tickle pulse and drive signals needed to test and operate the laser properly. Alternatively, most motion control software packages are designed to provide the proper pulse protocol.

The Modulation pins on both the “D” connector, **pin 3 (low) and 4 (high)**, and the RJ-45, **pins 1 (high) and 6 (low)**, are designed to allow either *floating* or *grounded* input modes.

Both the High and Low pins should be used in either case. A software setting made through the RS232 interface will either ground Modulation Low or leave it floating. **Factory setting is set to ground Modulation Low.**

It is possible to use the Modulation High pin only if the Modulation Low pin is grounded by software settings or by a physical wire, however, depending on the ground integrity of the host system and level of ground noise this may not be the best solution.

The diagram below shows the circuit of the modulation input interface:



System Test

The operation of the laser is possible after the above connections are completed. To test the laser, apply DC power (and the tickle command signal if desired). If the software settings require a key switch, toggle it off and on. After about 6 seconds the system is armed.

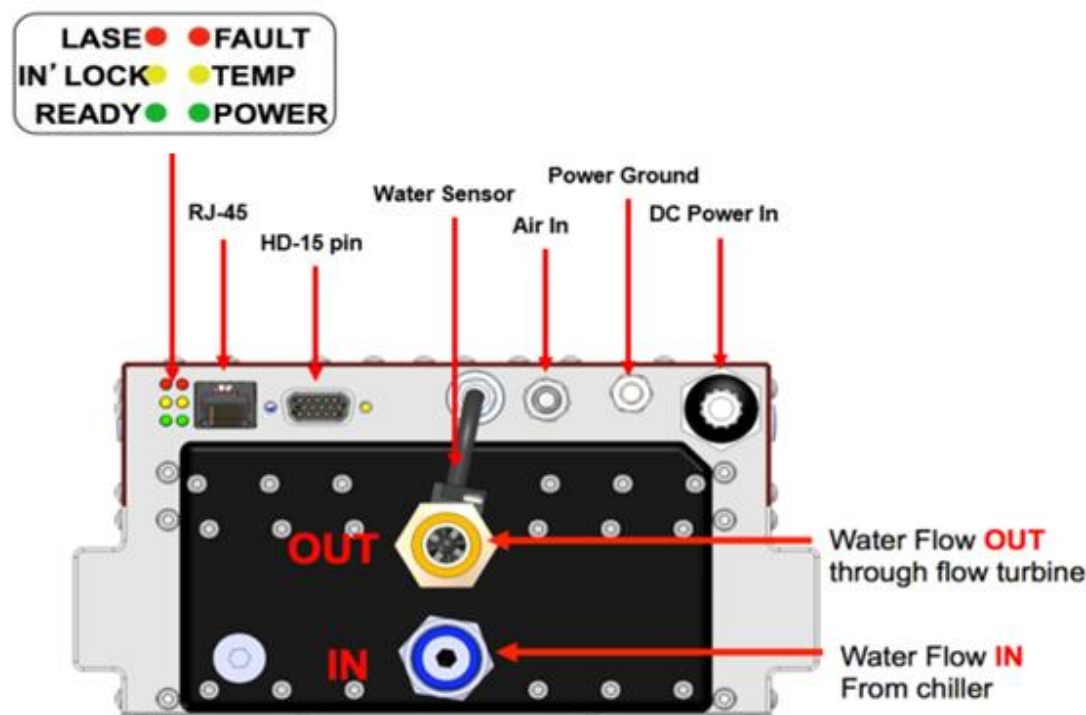
The interlock connections must be closed to operate the system.

Fault conditions can be detected by viewing the LED indicators on the rear of the laser. Water and airflow faults take 20 seconds to indicate a fault. The signals monitored with LEDs are:

LASER READY	Lights (cw) when the laser controller is ready for operation
OVERTEMP	Lights (cw) when the RFPA is getting too hot*
FAULT	Lights (or blinks) when the controller is in a Fault state
LASE LED	Lights with varying brightness whenever RF power is generated
POWER	Lights (cw) whenever DC power is applied
INTERLOCK	Lights (cw) when the interlock switch is closed
WATER FLOW	Fault (cw) and Temp blink when too low or high flow rate
AIR FLOW	Fault blinks and Temp cw when air is out of range

*The D200/D250 is water cooled and therefore the Overtemp light should never light up; however, if the cooling water gets hot enough this light will come on and the laser will fault.

Laser Indicator Lights



The following chart is provided for clarity and is specific to the D250 water cooled laser:

RED	off	On	on	blink	on	blink	blink
FAULT							
YELLOW	on	On	off	on	blink	blink	off
WARN							
Condition:	A	B	C	D	E	F	G

- A = Getting hot warning, but no-fault condition.
 - B = System faults: too hot/water too hot.
 - C = System fault: over/under voltage, other faults.
 - D = No air flow (system in continuous fault)
 - E = No or low water flow, too much water flow/pressure (system in continuous fault)
 - F = In the D250 configuration, this state is not allowed.
 - G = CPLD (Complex Programmable Logic Device) failure
- Note: A blinking red light is the same level of fault as a solid red light.

Beam Expanders and Other First Optical Surfaces



Caution

The optical intensity at the output window is **VERY** high ($>8500\text{W}/\text{cm}^2$). Any contamination to the window surface could cause runaway destruction. To protect the window, Iradion provides a power supply unit that includes a long-life air pump and filters to bathe the window in clean filtered air. Do NOT burn materials close to the laser. The flow of air may not be enough to overcome the explosive vaporization of objects near the output aperture.

The beam leaving the D200/D250 laser is very small and extremely intense. Optics positioned in the beam must be of the highest quality to survive without damage. The first lens of a typical system is most often a beam expander entrance optic.

Iradion **strongly** recommends that this first optical surface is kept extremely clean by mounting it in a tube that mounts to the face of the laser. The airflow from the laser can be used to purge the tube. The tube must have an escape hole(s) for the airflow. The holes should be halfway between the first optic and the face of the laser. If the back-pressure is too high, the laser will fault so the total area of the hole(s) should be between $\approx 50\text{ mm}^2$ and $\approx 100\text{mm}^2$.

In addition, this first optical surface should be at least **20 cm** from the face of the laser. This will help reduce the possibility that any explosive failure of the beam expander or other optic does not blow debris back into the laser and destroy the laser window.

By positioning a beam expander away from the laser, the beam quality can also be improved. The photo depicts the D200/D250, extension tube and beam expander which is mounted and aligned prior to shipment from Iradion



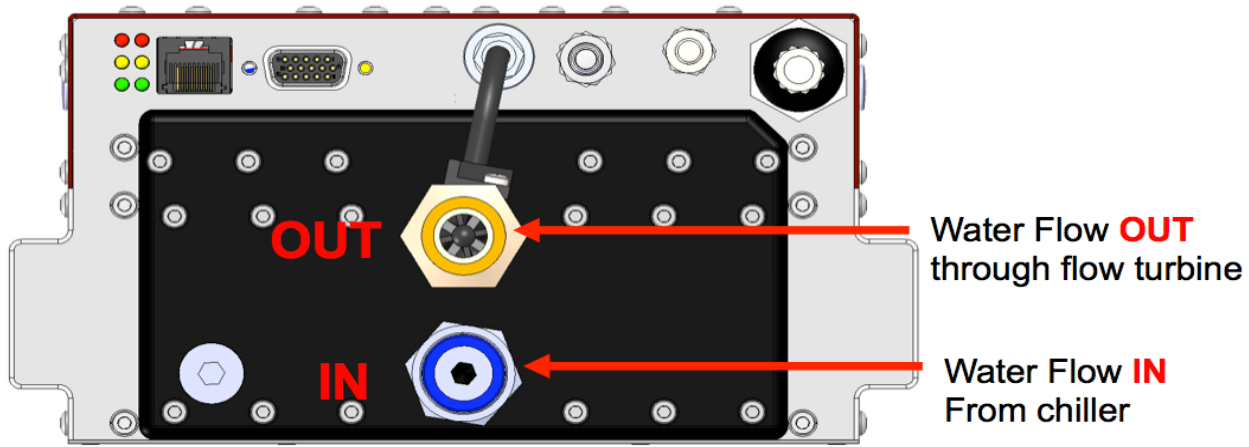
Failure to fully protect the optical surfaces of mirrors and lenses positioned within 50 cm of the laser face will result in damage as dust and smoke accumulate on them. Smoke and fine dust will also alter performance of the antireflective coatings on lenses allowing large reflections that could damage the laser or cause strange optical effects, including pulsations of the beam and mode distortions.

Any reflection of light directly back into the laser must be avoided.

Water Cooled Laser Connections

The D200/D250 laser requires water cooling connections.

The rear plate of this laser is pictured below:



Connections to IN and OUT require polyethylene tubing of ½ inch outside diameter that is capable of handling pressure of up to 60 psi (4 bar). The internal cooling components of the laser are rated at 60 psi.

The following materials are used in the cooling path of the laser:

- Delrin®
- Copper
- Viton® rubber

The recommended coolant is water. Additives should be used to control corrosion and algae as recommended by the manufacture of the chiller. Use high quality water such as distilled or deionized water to avoid scale buildup. Keep the concentration of water at above 90% relative to additives to maximize the specific heat of the coolant.



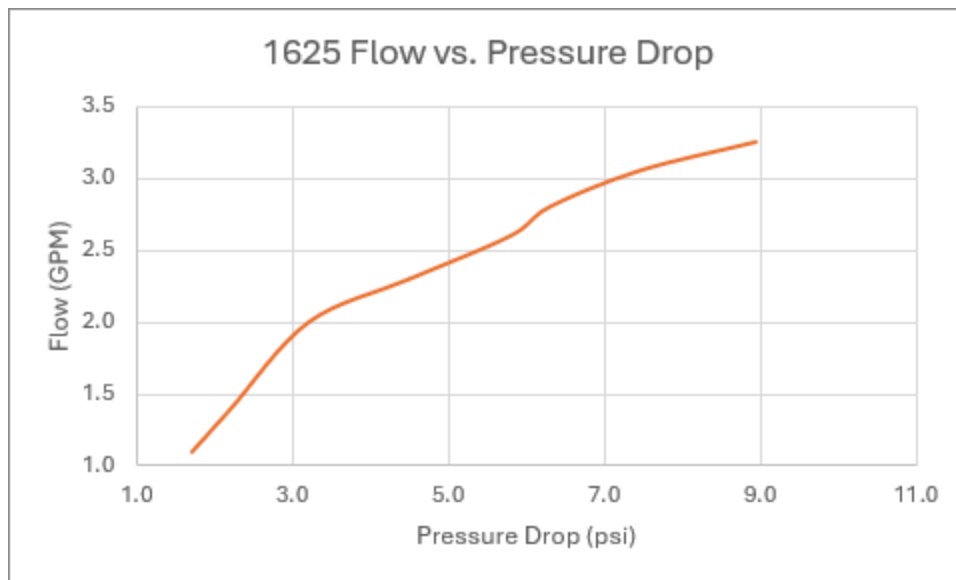
Caution

- Maintain the coolant pH above 7 to avoid damage to the copper cooling pipes.
- Never use tap water cooling. The mineral content, temperature or pH may cause damage.
- Never allow condensation to form on the laser.
- If condensation forms, DO NOT operate the laser until it's dry again.
- If any water leaks are detected at the laser, SHUT DOWN IMMEDIATELY!
- Incorrect flow direction will cause a system fault.
- **A water filter must be in line with the IN connection.**

Cooling Specifications

- 2 to 3 US Gallons per Minute (7.5 to 11 L/min) >90% Water
- pH >7.0
- <60 psi (4 Bar) pressure
- 18°C to 24°C set point
- Water filter that removes particles and rust on the inlet
- **No condensing allowed**

IRADION DESTINY: D250 Inlet vs Outlet chiller water pressure drop (1625 = DESTINY SERIES LASERS, 250 Watt)



Water Filter

Many closed loop water chillers come with an inline water filter. If this is the case, no additional filter is needed. However, if the water source is not filtered, then the water must be filtered with a conventional inline particulate filter. The filter must be on the inlet side of the cooling manifold. The filter protects against a build-up of debris in the manifold and cooling pipes, and most importantly, avoids potential jamming of the flow turbine blades. Small particles can get between the housing and blade tips and stop the turbine. If this happens, the laser **will** fault. It may become necessary to remove the outlet hose connected to the flow turbine and gently rotate the turbine blades with a paperclip to resolve a stuck turbine. The turbine will not jam if the water is within specification and is filtered.

Setting the Flow Rate

The D200/D250 measures the flow rate and will fault if the value is too low (not enough cooling) or too high (exceeding rated water pressure). The water flow rate can be monitored by connecting to the RS232 and running a special software package available from Iradion. Alternatively, the water flow rate can be set with an external flow meter. The use of a flow bypass valve can help control the flow rate from aggressive chillers.

Condensation

To use the following dew point table, look down the Air Temp column and locate an air temperature in

Fahrenheit or Celsius (°C values are shown in parentheses) that corresponds to the air temperature in the area where your laser is operating. Follow this row across until you reach a column matching the relative humidity in your location. The value at the intersection of the Air Temp and Relative Humidity columns is the Dew Point temperature in °F (or °C). The chiller's temperature setpoint must be set above the dew point temperature.

For example, if the air temperature is 85 °F (29 °C) and the relative humidity is 60%, then the dew point temperature is 70 °F (21 °C). Adjust the chiller's temperature setpoint to 72 °F (22 °C) to prevent condensation from forming inside the laser.

Refer to the dew point temperature table on the next page for a range of air temperature and relative humidity values. Remember that the laser's coolant temperature must be set above the dew point temperatures shown in the chart in order to prevent condensation.

Relative Humidity (%) Dew Point Table

Air Temp °F/°C	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%
60°F			32	36	39	41	44	46	48	50	52	54	55	57	59
16°C			0	2	4	5	7	8	9	10	11	12	13	14	15
65°F		33	37	40	43	46	48	51	53	55	57	59	60	62	64
18°C		1	3	4	6	8	9	11	12	13	14	15	16	17	18
70°F		33	37	41	45	48	51	53	56	58	60	62	64	65	69
21°C		1	3	5	7	9	11	12	13	14	16	17	18	19	21
75°F		37	42	46	49	52	55	58	60	62	65	67	68	70	73
24°C		2	3	6	8	9	11	13	14	16	17	18	20	21	23
80°F	35	41	46	50	54	57	60	62	65	67	69	71	73	75	78
27°C	2	5	8	10	12	14	16	17	18	19	21	22	23	25	26
85°F	40	45	50	54	58	61	64	67	70	72	74	76	78	80	83
29°C	4	7	10	12	14	16	18	19	21	22	23	24	26	27	28
90°F	44	50	54	59	62	66	69	72	74	77	79	81	83	85	88
32°C	7	10	12	15	17	19	21	22	23	25	26	27	28	31	31
95°F	48	54	59	63	67	70	73	76	79	81	84	86	88	90	93
35°C	9	12	15	17	19	21	23	24	26	27	29	30	31	33	34
100°F	52	58	63	68	71	75	78	81	84	86	88	91	93	95	98
38°C	11	14	17	20	22	24	26	27	29	30	31	33	34	36	37

The D200/D250 Power Supply and Air Pump Unit

Electrical Ratings

Parameter	Value
Voltage – Single Phase	208-240 V~
Current	20A
Frequency	50-60 Hz
Duty-Cycle	100%

Environmental Conditions

Parameter	Value
Use	Indoor
Altitude	2000m max
Humidity	90% max, non-condensing
Mains Fluctuation	±10% stability of input power

The D200/D250 Power Supply and Air Pump Unit



Danger - Serious Personal Injury

Earthed Ground

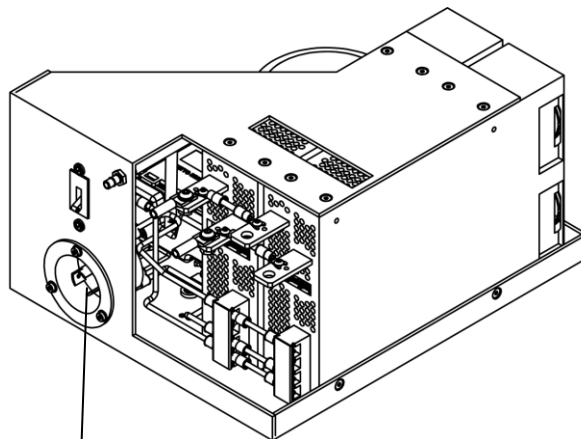
For safe operation, an Earthed Ground is required for Power Supply and Laser Operation.



Danger - Serious Personal Injury

Service Disconnect

When servicing the laser or its power supply, the Service Disconnect must be detached for safety. The Service Disconnect is the NEMA L6-20 Plug/Receptacle found on the rear of the Power Supply/Air Pump Unit.



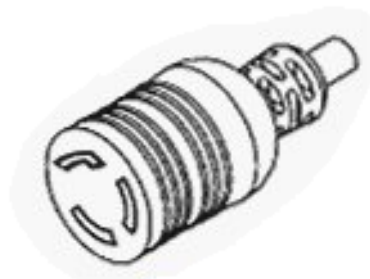
NEMA L6-20 Service Disconnect



Danger - Serious Personal Injury

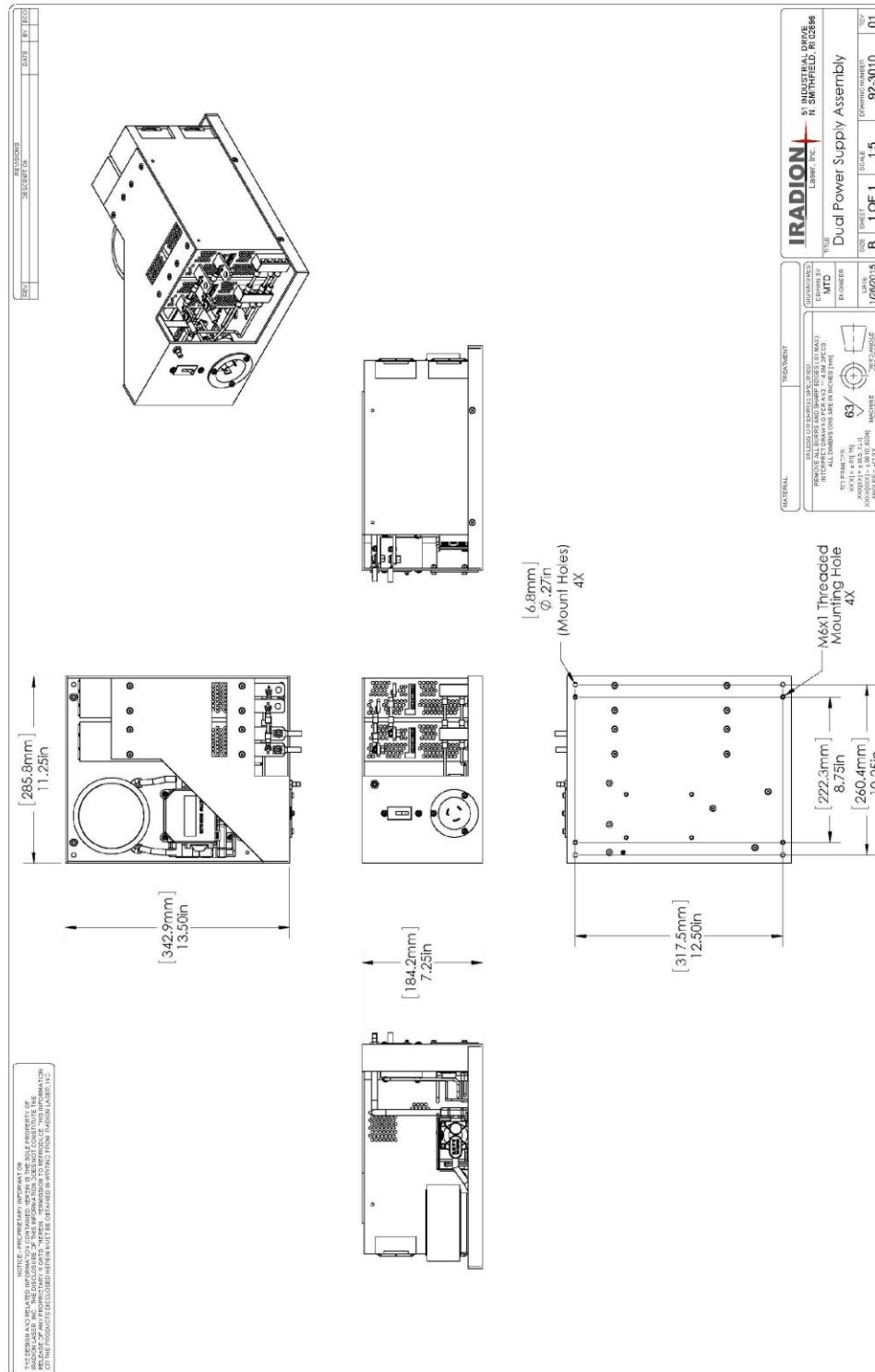
Mating Connector

The power supply and air pump unit is supplied with a NEMA L6-20R connector for the primary power connection.



All local electrical and fire codes must be followed.

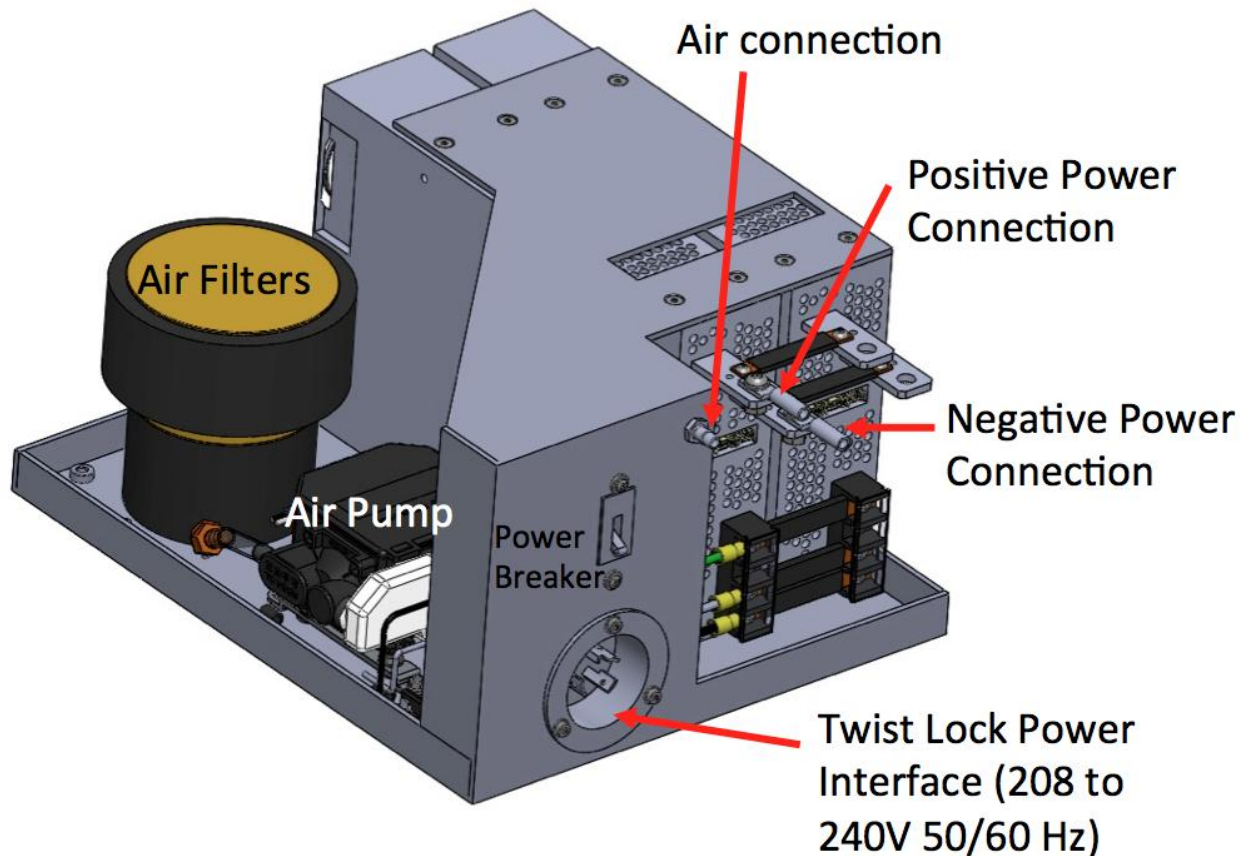
Mechanical Outline



Connecting the Power Supply and Air Pump

The D200/D250 laser comes with a separate power supply and air pump unit.

The unit also contains a long-life air pump and filters designed to provide exactly the right flow and pressure of clean air to the laser window. The laser will not operate if the air flow is not set correctly. It is NOT recommended that “house air” be used because of the exacting air pressure limits and flow limits that are monitored internally. **Pressure above 1.5 psi (0.1 Bar) can cause damage, and pressures below 0.25 can result in a laser fault.** *Connect the supplied blue air hose to the laser and power supply air connection points. The blue hose is made of a material that does not emit plasticizers in vapor form that can damage the window over time. Do not use other hoses without checking with Iradion.*



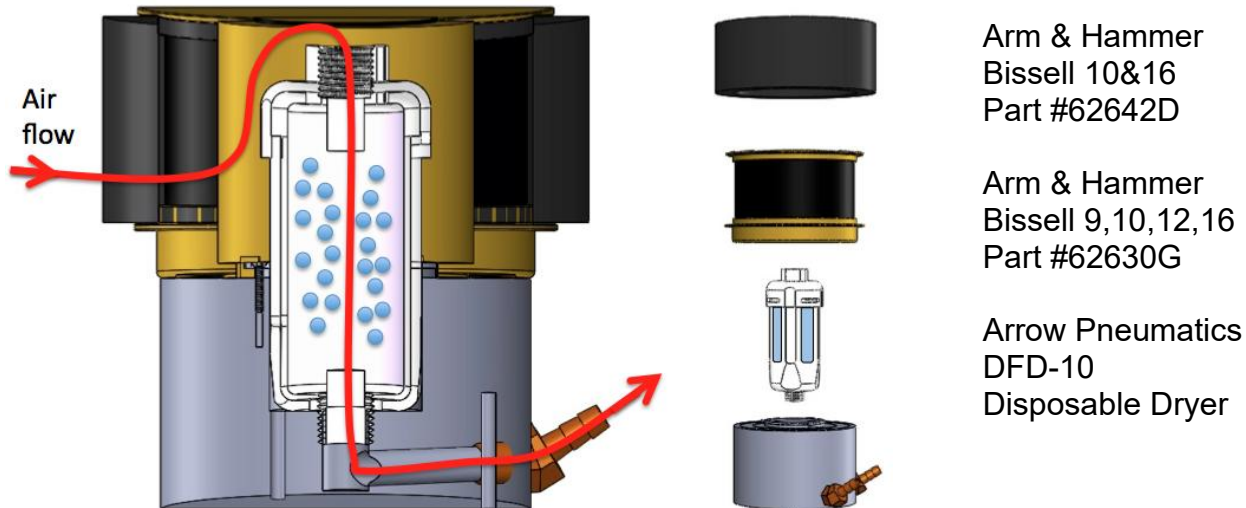
A twist lock plug is provided that will wire to the AC power source. This plug is inserted in the twist lock power interface. The Breaker must be OFF when power is applied to avoid powering up the laser accidentally.

Position the power supply unit in the host system such that access to the air filters is convenient. Frequent servicing of the filters may be required depending on how clean and dry the air is around the unit.

Power Supply and Air Pump Service

The D200/D250 laser requires airflow to protect the output window. An internal pump and filters provide the correct flow and pressure. The air filters are designed to remove dust, neutralize acids in the air, remove hydrocarbon compounds that could cause thermal lensing of the beam and dry the air. The main filters are at the pump input. There is a final filter inside the laser that is designed to last the life of the laser assuming that the pump filters are maintained.

The main filters are repurposed vacuum cleaner filters made by Arm & Hammer. These outer filters are made to fit “Bissell” number 10 and 16 vacuum cleaners. These filters can be bought from Iradion, sourced locally at Walmart stores or ordered online. The inner filter (see filter diagram) also serves as a sound muffler for the air pump. Operation without this filter will result in high noise levels and may cause a fault. The inner filter is an air dryer and can also remove oil and dust. The outer filters are designed to remove the bulk of the dust and neutralize acids generated by laser engraving certain organic materials like wood. The carbon in these filters absorbs hydrocarbons gases that can cause thermal lensing of the beam.



The outer filters can be washed in water. It is recommended to wash the outermost foam filter if it gets visibly loaded with dust. It is critical that any washed filter be completely dried before use to avoid rapid exhaustion of the inner dryer filter that must be replaced if the blue color fades away.

The inner dryer filter has a life of between 300 and 700 hours of pump time. The humidity of the air determines the filter life. This filter should be checked every 300 hours of operation by removing the outer filter and checking that there is some blue color left in the filter window.

The outer dust filter is removed by rotating it slightly counter clockwise and pulling up. This outer filter uses a bayonet type engagement.

The dryer filter is removed by unscrewing it from the plastic base. These filters come with a red plug in each end. The plugs must be removed before installation. In addition, the dryer filter installed in the power supply unit is shipped with these plugs in place.

The laser will not operate until the dryer filter is unscrewed from the filter housing and the plugs removed! The laser is shipped with two spare DFD-10 dryers.

Serviceable Parts

Part Name	Manufacturer	Part #	Service Period	Method
Primary Filter	Arm & Hammer	62642D	As required indicated by dust accumulation.	Wash with detergent and warm water. Dry thoroughly.
Secondary Filter	Arm & Hammer	62630G	As required indicated by dust accumulation.	Wash with detergent and warm water. Dry thoroughly.
Dryer Filter	Arrow Pneumatics	DSD-10	Local Environment Dependent. 700 hr. MAX	Inspect filter window for blue every 300hr. If not present, replace filter

Air Ventilation

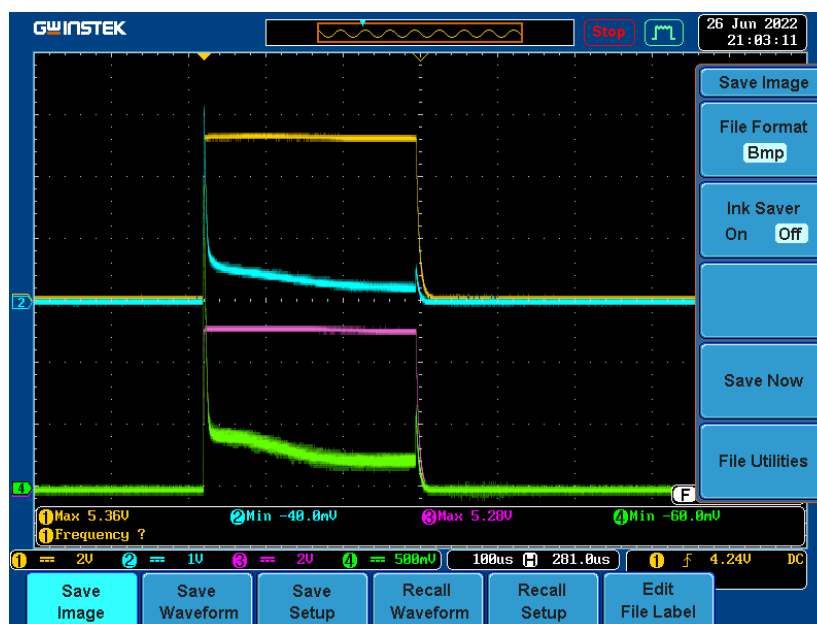
The Power Supply and Air Pump module contains two closed-housing power supplies that are individually forced-air cooled. The Power Supply and Air Pump module requires adequate air ventilation for cooling and accommodations must be considered when mounting and/or integrating this module.

Directional Coupler:

The laser interface connector provides signals that carry information about the RFPA and the match to the laser. There are 2 independent RFPAs and 2 sets of directional coupler signals. The reflected signals display the reflected RF power waveforms.

These lines are most useful in determining the quality of the match between the laser and RFPA as well as indicating the proper operation of the laser. The forward signals display the forward RF power waveforms. This line provides a measure of the forward power level.

The expected waveforms for the Forward and Reverse signals are provided here for a laser firing at 25% duty. If the waveform amplitude for both the forward and reverse signals are similar, it can be assumed there is a problem with the laser.



Troubleshooting

Problem	Solution
The key switch is on, but the system is not ready. (Key Switch function enabled)	Toggle the Key Switch.
The unit is in the Ready mode, but will not respond to commands.	The Interlock Switch is open. Mod LOW is not properly grounded.
The Over Temp Light lights up.	The cooling water is too hot for operation. Improve cooling (Fault 45°C, Warning 40°C).
Laser power seems low.	Possible RFPA malfunction.
Fault light is lit or blinking.	The water flow is out of range. * The airflow is out of range. The DC voltage is out of range.

*If the water flow is in the right direction and flowing at the correct rate, but a water fault still shows (see “Indicator Light Details” below) it is possible that the water flow turbine is stuck. This can happen if the water is not clean or scale deposits built up. It may be possible to remedy the issue with the following procedure:

1. Power down the laser and water supply.
2. Remove the water hose from the water flow turbine.
3. Using a straightened paper clip, gently reach into the turbine and nudge the rotor so that it moves.
4. Check to see that there is no debris in the turbine.
5. Replace the hose and test laser.

Indicator Lights Details

The following chart is provided for clarity:

Fault RED FAULT	off	on	on	blink	on	blink	blink
Temp YELLOW WARN	on	on	off	on	blink	blink	off
Condition:	A	B	C	D	E	F	G

A = Getting hot warning, but no-fault condition.

B = System faults: too hot/water too hot.

C = System fault: over/under voltage, other faults.

D = No air flow (system in continuous fault)

E = No or low water flow, too much water flow/pressure (system in continuous fault)

F = in the D250 configuration, this state is not allowed.

G = CPLD (Complex Programmable Logic Device) failure

Note: A blinking red light is the same level of fault as a solid red light.

Iradion Laser GmbH | Justus-von-Liebig-Ring 8 | 82152 Krailling
Germany Phone: +49 (89) 899 360 - 1200
info.eu@iradionlaser.com | www.iradionlaser.com

Iradion Laser Inc. | One Technology Drive | Uxbridge, MA 01569
USA Phone: +1 (401) 762 - 5100
info.us@iradionlaser.com | www.iradionlaser.com



Patents: US 7460577 B2
US 8295319 B2
P/N: 92-3064_Rev.1 10/2025