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CL SERIES

CLASS IIIb < 500 mW

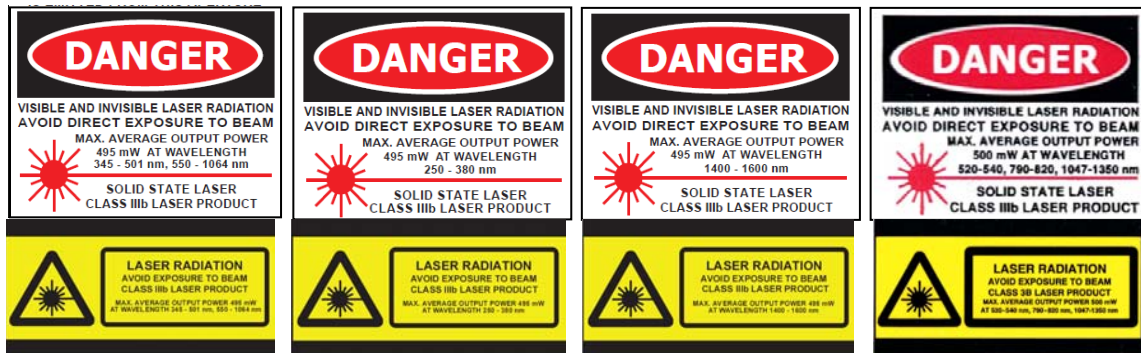


Diode Pumped Solid State CrystaLaser[®]

USER MANUAL

CL473, CL523, CL527, CL532, CL542, CL555, CL561, CL593, CL656, CL660, CL671, CL946, CL1030,
 CL1047, CL1053, CL1064, CL1080, CL1313, CL1320, CL1340

READ THIS MANUAL CAREFULLY BEFORE OPERATING THE LASER



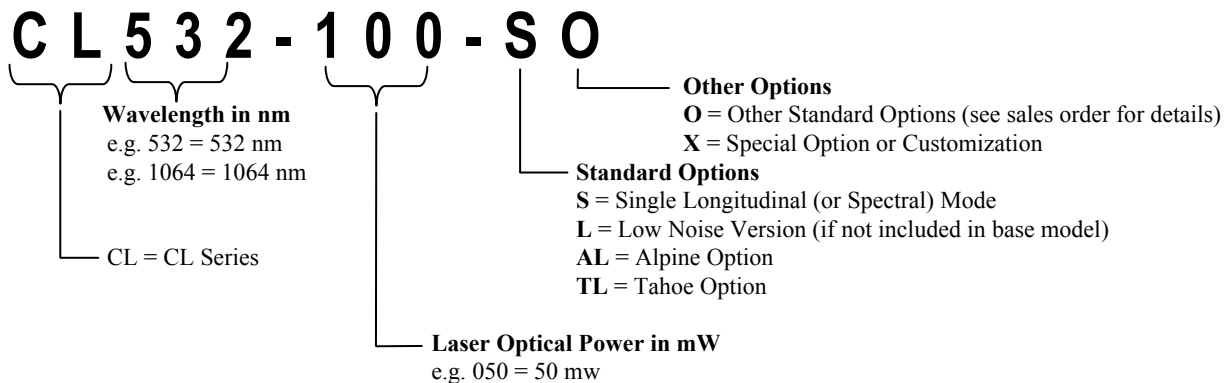
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This **Solid-state CrystaLaser**[®] is easy to operate, but read this manual carefully before operating it for the first time.

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MODEL NUMBER DESCRIPTION



CONTENTS OF THE PRODUCT PACKAGE

Carefully check the contents of the laser system package. The package should include the following standard items:

1. Laser head
2. Laser power supply (CL-2000, or optional CL-2005)
3. Power cord
4. Cable to connect laser to power supply
5. Interlock connector (this one has connections for Analog Modulation)
6. Master key
7. This manual
8. The Certificate of Compliance
9. Any hardware options that were ordered (e.g. optical fiber)


If any items are missing, immediately contact CrystaLaser Customer Support.





LASER SAFETY



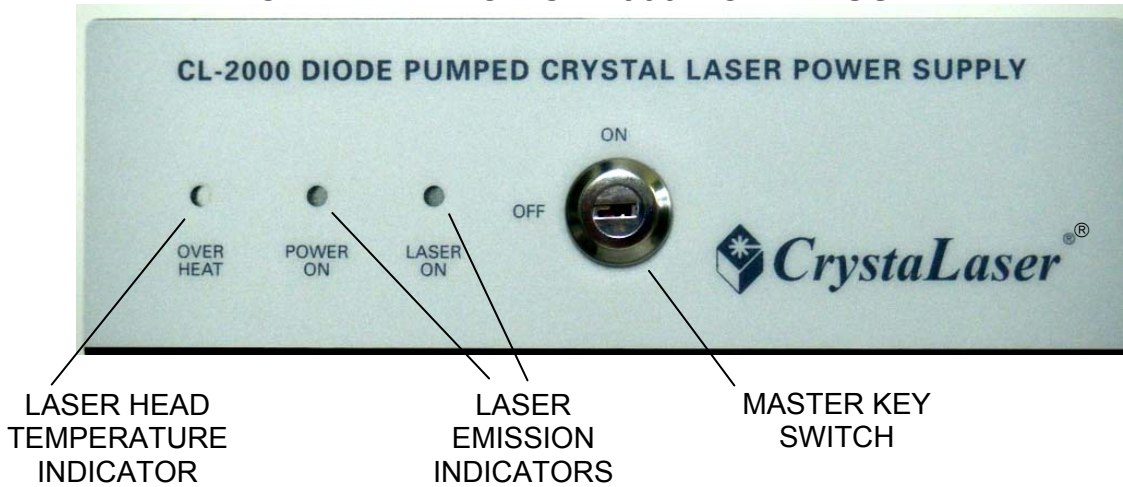
- a. **Do not try to open the housing of the laser at any time.** The housing of the laser head is sealed and not removable. There are no user serviceable parts inside the laser head. It is not permitted to open or remove the housing during at any time during the operation, maintenance or service of this laser. Opening the cover of the laser head is dangerous and may result in hazardous radiation exposure. It will also cause laser failure, and voiding of the warrantee.
- b. **Do not** aim the laser at an individual's eye. **Do not** permit laser tracking of nontarget vehicles or aircraft.
- c. Permit only experienced personnel to operate the laser.
- d. Operate the laser only in a restricted area, and place a warning sign on the door. The laser should be operated within a localized enclosure, or in a light-tight room with interlocked entrances to assure that the laser cannot emit while a door is open.
- e. The laser beam or its specular reflection should never be directly viewed with optical instruments such as binoculars or telescopes without sufficient protective filters.
- f. Make sure that there is nothing in the path of the beam which can return direct reflections into the laser.
- g. Enclose as much of the beam path as possible. Even a transparent enclosure will prevent individuals from placing their head or reflecting objects within the beam path. Terminations should be used at the end of the useful paths of the direct and any secondary beams. Remove all unnecessary mirror-like surfaces from within the vicinity of the laser beam path. Always double check that there are no obstacles in the beam path which will be likely to cause dangerous reflections.
- h. Never push objects of any kind into the power supply through cabinet slots as they may touch dangerous voltage points or shot out parts that could result in a risk of electric shock or cause the laser system failure. Never spill liquid on the product.
- i.  This is a **Class IIIb** laser product. **VISIBLE AND INVISIBLE RADIATION. AVOID EXPOSURE TO BEAM.** The laser output is of high intensity. The maximum laser output power from the aperture of the laser is < 500 mW. The output beam may also include output in the fundamental frequency and the pumping frequency. The fundamental frequency has a power which is usually under 2 mW, and can be found in Table 1 in the back of this manual. The pumping frequency is 800 ± 10 nm and has a maximum average laser power of less than 5 mW. A potential eye hazard exists for the direct beam or a specular reflection. Always use proper laser eye protection: safety goggles. Ensure that the goggles are suitable for the wavelength being emitted and they fit snugly. Wavelengths are shown by laser model in Table 1 in the Appendix.
- j. The "LASER ON" and "POWER ON" LED lights, located on the front panel of the power supply, are the laser emission indicators.

The color for these indicator LED's are also shown in Table 1. The red indicator LED has a wavelength of $650\text{nm} \pm 50$ nm. These are designed to be visible through most laser safety glasses used for the laser wavelength, but the user should make sure that these indicator lights are visible through the specific safety goggles being used.

OPERATING PROCEDURES

CL-2000 Power Supply

FRONT PANEL OF CL-2000 POWER SUPPLY

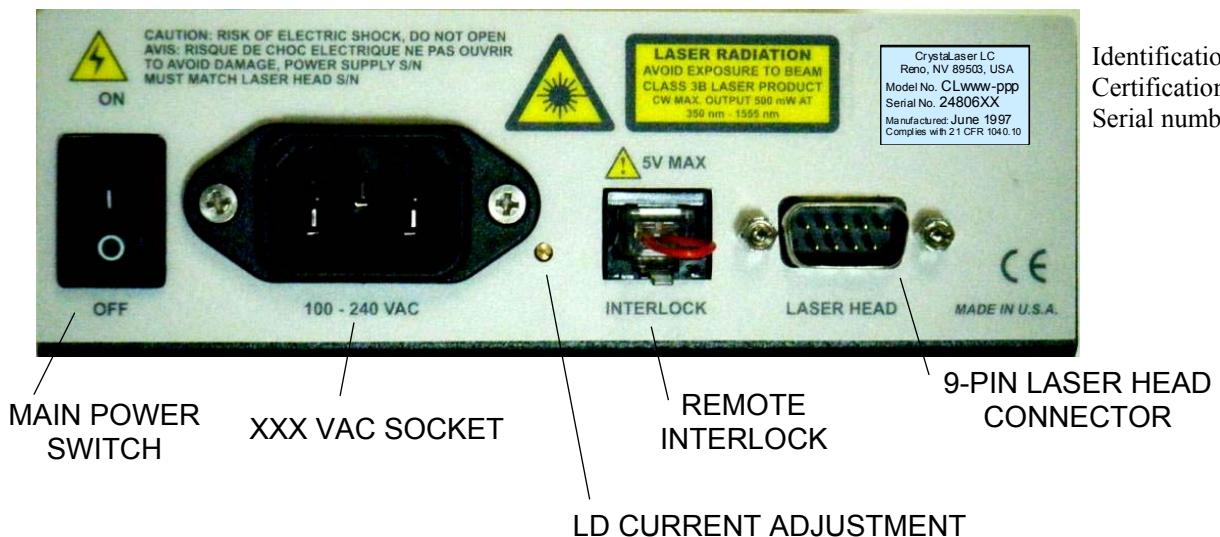


For the CL-2000, the LASER ON and POWER ON lights are the laser emission indicators. The OVER HEAT light is a caution and an indicator of the temperature of the laser head. If the over-heat light is on during the first 2 minutes when main power is on, then the LED light is off automatically, this is normal and it is not actually over-heating.

If the OVER HEAT light is continuously on or flashing for more than 3 minutes, the laser head is overheated; the laser should be turned off. Otherwise, the lifetime of the laser diode may be shortened. Before turning on the laser again, it is necessary to increase the heat dispersion of the laser head by, for example, increasing the surface area of the heatsink, or connecting the heatsink with a large cold metal sheet.

Keep the master key in a safe place with authorized personnel. The manufacturer has no spare key.

BACK PANEL OF CL-2000 POWER SUPPLY



Identification and Certification label Serial number

CL-2005 (optional upgrade)



CL-2005 POWER SUPPLY'S FRONT PANEL

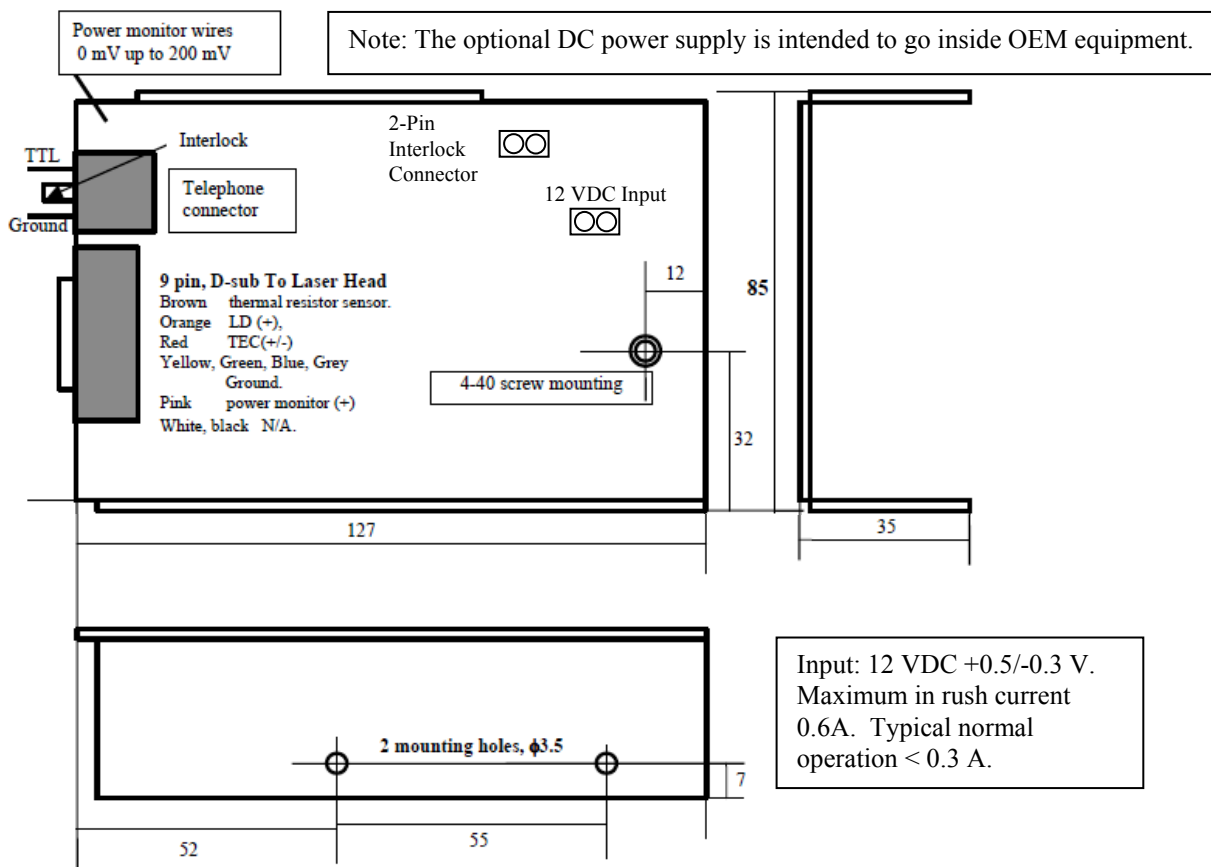
OUTPUT POWER DISPLAY
(LASER EMISSION INDICATOR)

POWER
ADJUSTMENT
KNOB

MASTER KEY
SWITCH

The CL2005 is an optional power supply (upgrade). The OUTPUT POWER display also functions as the laser emission indicators. Power is displayed as follows: For 500-950 mW lasers, the display shows the power in mW as 0xxx (e.g. 0800 = 800 mW). For >1W lasers, the display shows the power in Watts (e.g. 02.50 = 2.5 Watts). The output power of the laser can be adjusted using the POWER ADJ knob.

DC power supply



SET-UP & OPERATION



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

Notice: *Dropping the laser, or subjecting it to heavy vibration or strong shock may result in laser failure and voiding of warranty.*

1. Before starting, thoroughly read and understand the “Laser Radiation Safety” and the “Operating Procedures” sections. Follow safety rules at all times.

2. Mount the laser head onto a heat sink.

The laser will operate on optical table without any mounting hardware. Distortion-free mounting is required. The base to mount the laser needs to be 0.01 mm flat. Mounting hole locations are shown in the drawings in the appendix. We recommend only to use 3 screws to mount the laser. We recommend to use #4-40 or 2.5 mm screws and corresponding flat washers and lock washers to mount the laser, with a mounting torque of 2 to 3 lbs-in on each screws. . If the mounting torque exceeds 5 lbs-in, permanent damage may occur. Any distortion caused by improper mounting will cause the laser to fail and the warranty is void.

Note: We recommend that the temperature of the laser head case temperature be maintained at a constant temperature during operation. This will result in the most stable operation. The ambient temperature and the thermal characteristics of the plate that the laser laser is mounted on (which acts as a heat sink), must allow the laser to stay within the required operating temperature. Refer to the table below for operating temperature ranges.

Product Family	Laser Case Temperature Range, Maximum	Laser Case Temperature Range, Best Stability	Ambient Temperature	Ambient Temperature, Recommended
CL	10°C to 35°C	20°C to 28°C	10°C to 35°C	20°C to 25°C *

* 8"x8" (20cm x 20cm) metal plate should usually be a sufficient heat sink for this range. Additional heating or cooling may be needed outside this range.

3. Connect the laser head to the power supply

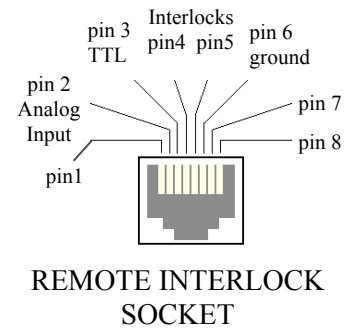
Notice: *Mis-connecting the laser head will cause the laser failure. Lasers*

Connect the laser head and the laser power supply. Make sure that the Serial No of laser head and the Serial No of the power supply is the same. Each laser head having a product serial number (S/N) should **only** be connected with the laser power supply having the same S/N; Otherwise, the laser will fail. **Do not** connect the laser head to the other socket. The laser power supply has been adjusted for the corresponding laser head.

4. Connect the remote interlock, and optional TTL signal to the power supply

The socket of the remote INTERLOCK is at the rear board.
Short-circuiting pin 4 to pin 5 will keep the laser on.

For TTL option laser, apply the TTL signal on Pin 3 and Ground Pin 6 of the connector in order to turn the laser on/off. **Never** apply electricity voltage exceeding +/-5 volts on the pins of the socket. For modulating the laser output, we recommend using 0 V (laser off) and 3 to 5V (laser on) level square signals, applied to pin 3. The required output resistance of the TTL circuit < 500 Ω .



If you ordered the analog modulation option, then connect the analog input signal to pin 2.

5. Turn the master key switch to the OFF position.

6. Connect the power cord to the power supply

Check the line voltage before plugging the power cord into the electrical power source. Make sure it is the same as the voltage indicated on the back panel of the laser power supply, near the power receptacle.



Caution: The laser power supply is equipped with a 3-wire grounding type plug, a plug having a third (grounding) pin. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace the plug. **Do not defeat the purpose of the grounding-type plug.**

Power consumption of the laser system is <15 Watts.

The laser is now ready to turn on for operation.

7. Turn on the main power switch.

The POWER ON indicator light should go on. Allow the laser to start to warm up for 30 seconds before proceeding to the next step.

8. Manually open the aperture shutter.

9. Turn on the master key switch.

After a >30 seconds delay, the master key switch can be turned on by an authorized person. The LASER ON indicator light should go on. In this state, the laser can emit a good quality beam from the aperture after laser warms up, whenever the aperture shutter open. The laser output will be stable in < 3 minutes

SHUTTING DOWN

1. Use the master key switch to turn **off** the laser.
2. Close the aperture shutter.
3. Turn off main power switch.

TROUBLESHOOTING AND SERVICE



Caution: Opening or removing the housing of the laser head, or the cover of the power supply may expose you to the danger of laser radiation, or the risk of electric shock, and may cause failure of the laser system. **Do not open the housing of the laser head or the cover of the laser power supply!** Doing so will also void the warranty. If necessary, return to CrystaLaser for repair.

CUSTOMER SUPPORT

If the laser has any problems, please contact CrystaLaser Customer Support. Do not attempt to service this product yourself. The housing or cover of the laser head is fixed and is not removable.

RETURNING THE PRODUCT

If the laser needs to be returned to us, please contact us to receive an RMA number. You may fill out the RMA form on the web site: www.crystalaser.com/rma. Return shipments will not be accepted without an RMA number.

Please ship the laser well packaged, prefer using the original box, through **UPS** with freight prepaid.

TROUBLESHOOTING

1. If the master key switch is turned on, but the laser does not go on, and the laser on light is off, then check the remote interlock.
2. If the output beam is not the correct transverse mode or the output does not meet the specifications, please try turning the **key switch** off and then on again.
3. If the laser power is not correct, first check to make sure that the laser and the power supply have matching serial numbers.

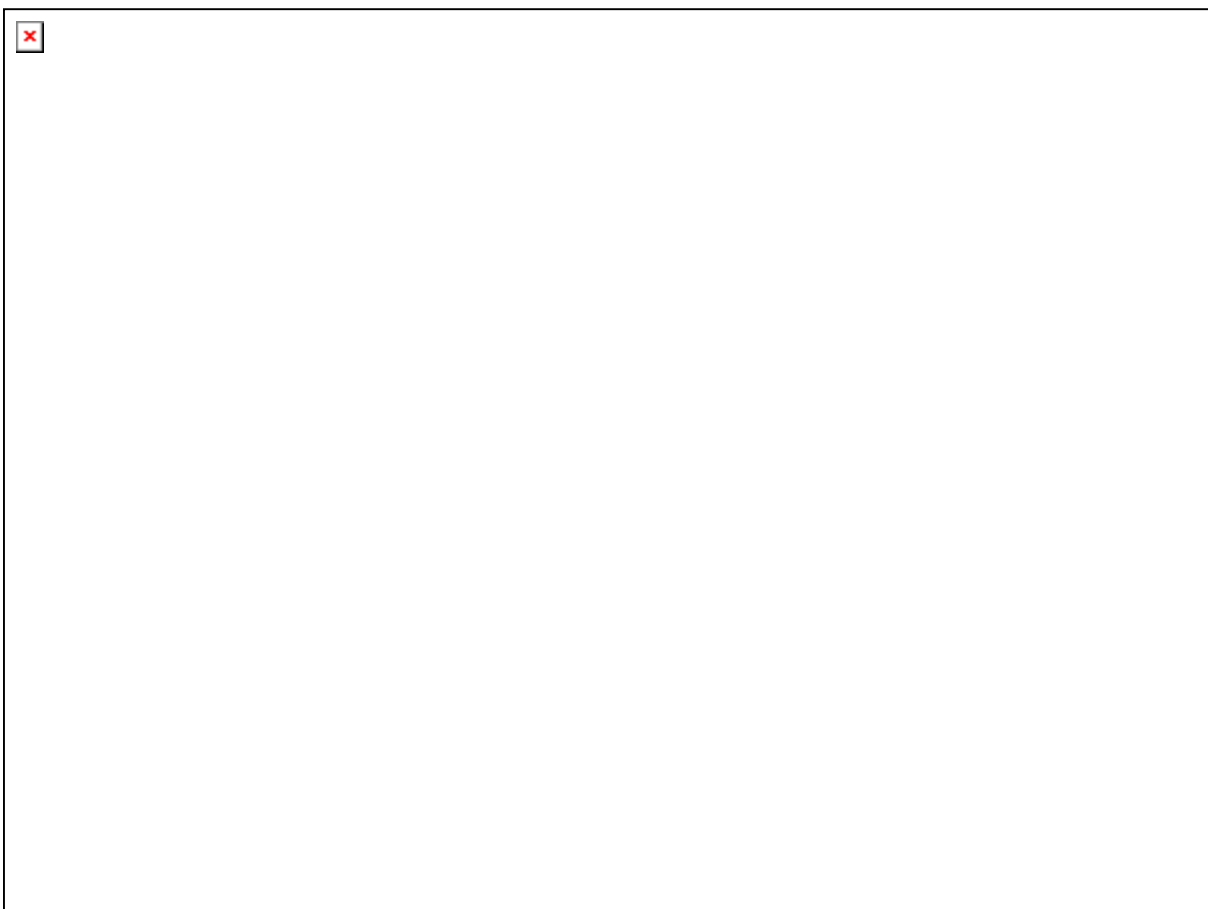
ADVANCED PROCEDURES

Adjusting the laser output power

The LD current has been set properly by the manufacturer. The limit of the LD current is already set by the manufacturer to protect the laser diode. The adjustment through the adjusting screw located on the rear board shown in page 5 is permitted. Normally do not adjust it. If you do need to change the laser output, you may use the optical attenuator to reduce the laser output. **Please notice: Changing the LD current may change the stability of the laser output and may increase or reduce the longitudinal oscillating modes of the laser, and may increase or reduce the output noise.** Turning the current adjusting screw counter-clockwise will reduce the LD current and will reduce the laser output, and may prolong the life time of the laser diode. In most cases, the laser power adjustment screw is already set at maximum at the factory, but turning the current adjusting screw clockwise may increase the LD current and will increase the laser output and reduce the lifetime of the laser diode.

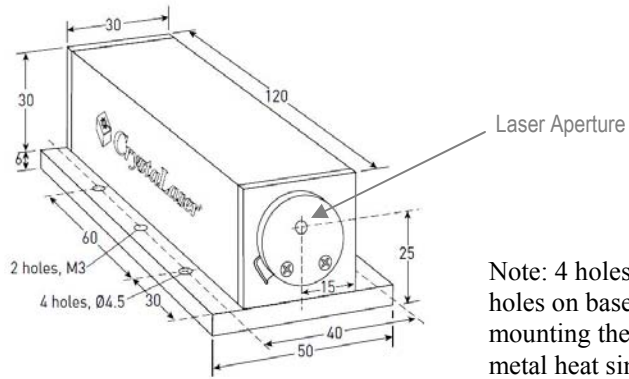


CL-2000 Power Supply Dimensions



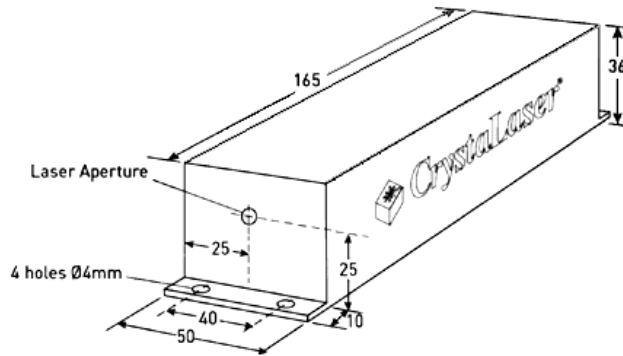
Laser Head Dimensions (all dimensions in mm)

Type 1 platform (Most Common)



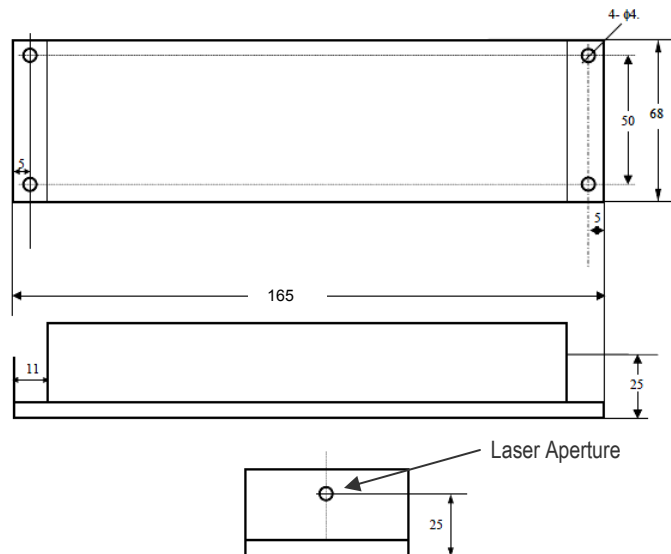
Note: 4 holes and 2 screw holes on base plate for mounting the laser head on a metal heat sink.

Type 2 platform



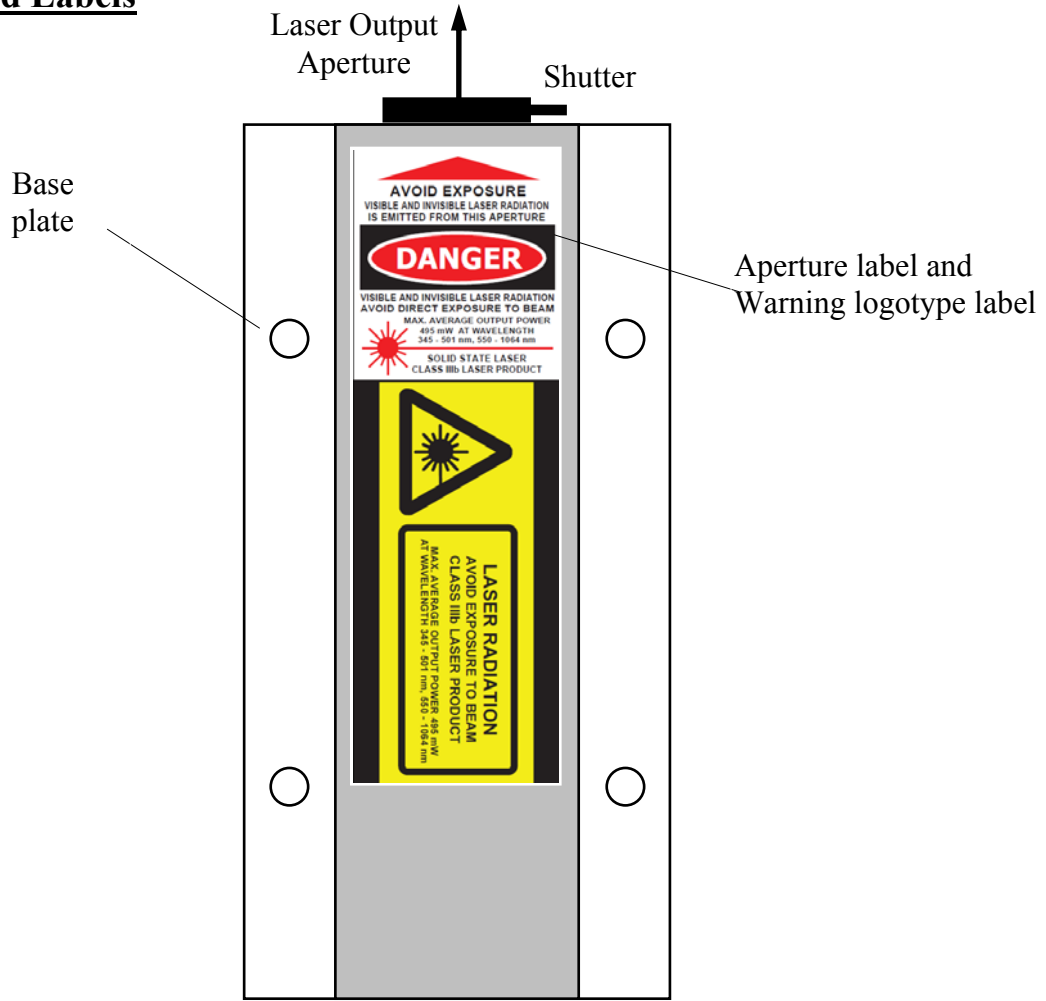
Type 3 platform

SIZE IN mm

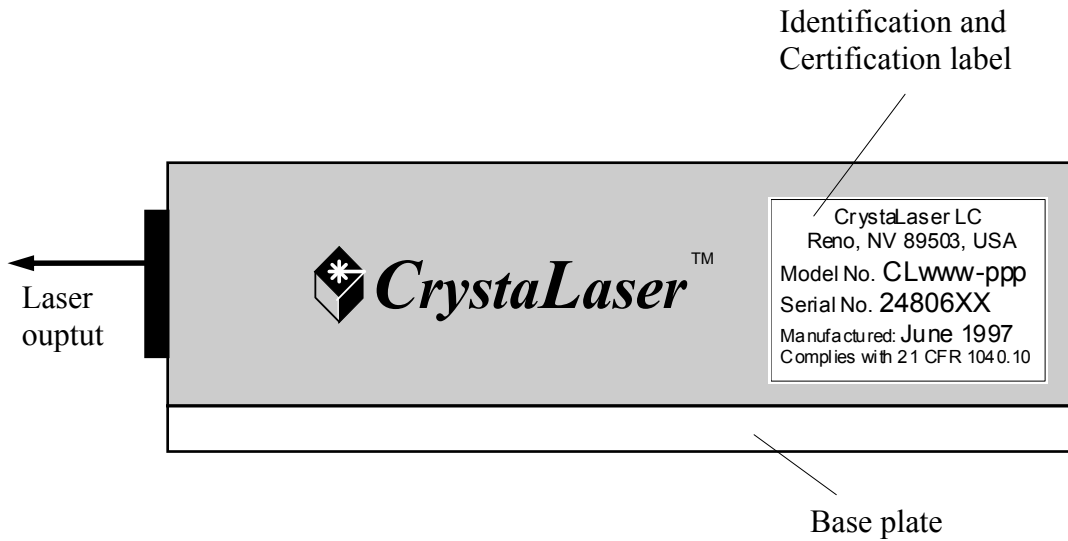


Laser Aperture

Laser Head Labels



Top View



Side View

Table 1 – Product Name vs. Wavelengths and Indicator LED colors			
Product Name	Primary Wavelength (nm) <500mW	Fundamental or Pumping Wavelength & power (nm, mW)	Indicator LED Color
CL473	473	946 <5mW, 810±10 <5mW	Red
CL523	523	1047 <20 mW, 810±10 <5mW	Red
CL527	527	1053 <20 mW, 810±10 <5mW	Red
CL532	532	1064 <20 mW, 810±10 <5mW	Red
CL542	542	1084 <20 mW, 810±10 <5mW	Red
CL555	555	1111 <20mW, 810±10 <5mW	Red
CL561	561	1064 <20mW, 810±10 <5mW	Red
CL593	593	1064 <20mW, 810±10 <5mW	Red
CL656	656	1313 <5 mW, 810±10 <5mW	Green
CL660	660	1320 <5mW, 810±10 <5mW	Green
CL671	671	1342 <5mW, 810±10 <5mW	Green
CL946	946	810±10 <10mW	Red
CL1030	1030	810±10 <10mW	Red
CL1047	1047	810±10 <10mW	Red
CL1053	1053	810±10 <10mW	Red
CL1064	1064	810±10 <10mW	Red
CL1080	1080	810±10 <10mW	Red
CL1313	1313	810±10 <10mW	Red
CL1320	1320	810±10 <10mW	Red
CL1340	1340	810±10 <10mW	Red