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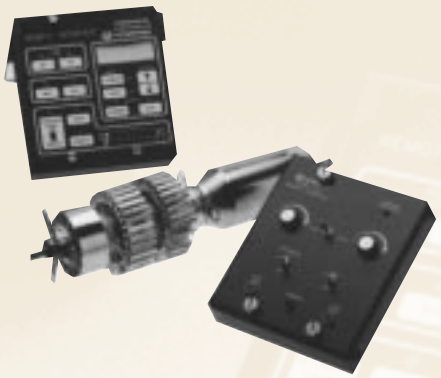
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Argon Laser Systems

- **Integral-mirror, metal-ceramic construction**
- **Hands-off operation**
- **Ultralow noise**
- **Fast warm-up**
- **Rugged construction**
- **Vibration isolation**
- **Ultrastable resonator**
- **Ultrastable beam pointing**
- **Extended lifetime**
- **Cylindrical packaging**
- **5,000 hour warranty**

Uniphase is the world's leading manufacturer of air-cooled ion laser systems. With tens of thousands of units in the field, our 2010 Series systems are the lasers of choice for complex, high-resolution OEM applications such as flow cytometry, DNA sequencing, graphic arts, and semiconductor inspection.

Breakthrough technology. With the introduction of the 2010 Series, the first commercial argon laser systems to incorporate hard-sealed internal mirrors on a metal-ceramic discharge tube, Uniphase established new industry standards for performance and reliability in air-cooled ion lasers. The discharge tubes, including the mirrors, now could be vacuum baked at very high temperature to eliminate all contamination. Today, laser life is measured in years, not weeks or months, and the need to clean optics in the field has been completely eliminated. Furthermore, 2010 Series lasers are extremely stable over the entire range of operating current and temperature.

The compact 2110 Series power supplies can be operated in either light- or current-control mode, and their patented active filter technology reduces noise by a factor of four over earlier units. The systems will work throughout the world, without a transformer, on any standard single-phase voltage source. Remote interface controllers are available to facilitate incorporation of the 2010 laser systems into your application.

Testing and certification. The 2010 Series comprises four models. All have received CE certification, and most have been tested and approved in accordance with UL ,EN, and/or FCC standards.

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Specifications

Output Power Specifications

Uniphase output power specifications are end-of-life specifications. Typically, when the laser is shipped from the factory, the output power is from1.5 to 2.5 times greater than the power specified in the table below–if the laser is operated in current control at maximum current. When the laser is operated in light control mode at the specified output power, the tube current initially will be very low. Gradually, as discharge losses increase due to gas depletion, the tube current will increase to compensate for the losses and to maintain stable output power. End of life is reached when the system can no longer maintain specified power at maximum tube current.

Specifications

Model Number, Wavelength Option	*Output Power (mW)*
(SL) Single Line Models, 488 nm, TEM_{00}	
2012-4SL	4
2011-10SL or 2014-10SL	10
2011-20SL or 2014-20SL	20
2011-30SL or 2014-30SL	30
2013-75SL	75
(GL) Green Line Models, 515 nm, TEM_{00}	
2012-2GL	2
2011-10GL or 2014-10GL	10
2011-15GL or 2014-15GL	15
2011-20GL or 2014-20GL	20
2013-75GL	75
(VL) Violet Line Models, 458 nm, TEM_{00}	
2011-4VL or 2014-4VL	4
2011-5VL or 2014-5VL	5
2011-6VL or 2014-6VL	6
2013-15VL	15
(BL) Blue Line Models, 458, 476, 488, and 497* nm, TEM_{00}	
2012-5BL	5
2011-10BL or 2014-10BL	10
2011-20BL or 2014-20BL	20
2011-30BL or 2014-30BL	30
(ML) Multiline Models, 458, 476, 488, 497, 502, and 515 nm, TEM_{00}	
2012-10ML	10
2011-25ML or 2014-25ML	25
2011-40ML or 2014-40ML	40
2011-65ML or 2014-65ML	65
2013-150ML	150
(MLM) Multiline, Multimode Models, 458, 476, 488, 497, 502, and 515 nm, multimode	
2011-100MLM or 2014-100MLM	100
2013-300MLM	300

*wavelength may not be present

Common Optical Specifications

Beam diameter:	
Model 2011 System	
TEM_{00} (mm @ $1/e^2$ ±5%)	0.67
Multimode (mm @ $1/e^2$ ± 15%)	1.0
Model 2012 System	
TEM_{00} (mm @ $1/e^2$ ±5%)	0.62
Model 2013 System	
TEM_{00} (mm @ $1/e^2$ ±5%)	0.65
Multimode (mm @ $1/e^2$ ±15%)	1.0
Model 2014 System	
TEM_{00} (mm @ $1/e^2$ ±5%)	0.69
Multimode (mm @ $1/e^2$ ±15%)	1.0
Beam divergence:	
TEM_{00} (mrad ±5%)	0.95
Multimode (mrad ±15%)	3.0
Minimum polarization ratio	250:1
(all models linearly polarized except multimode versions)	
Beam pointing stability (over 2 hours):	
Temperature range ± 3° C after warm-up (mrad)	< ±30

Common Power Supply Specifications

Amplitude fluctuations:	
Maximum noise	
20 Hz–2 kHz (p–p)	0.1%
20 Hz–20 kHz (p–p)	1.0%
20 Hz–2 MHz (rms)	1.0%
Maximum drift [light control mode, (for 2 hours)]	1.0%
Maximum warm-up time (minutes) (Model 2013, 15 minutes)	5

Input Power

Voltage (Vac ±10%)	100,	120,	200,	208,	220, 240	
Frequency (Hz)	47-63					
Phase	Single					
Maximum line current (A)						
with 2211 or 2214	20	17	12	12	10	10
-10SL, -20SL, -10GL, -15GL, -10BL, -20BL, -25ML, -40ML, -4VL, -5VL Heads with 2211 or 2214	23	19	13	13	12	11
-30SL, -20GL, -30BL, -65ML, -6VL, -100MLM Heads with 2212 Heads	12	10	8	7	7	6
with 2213 Heads	N/A	N/A	27	26	25	23

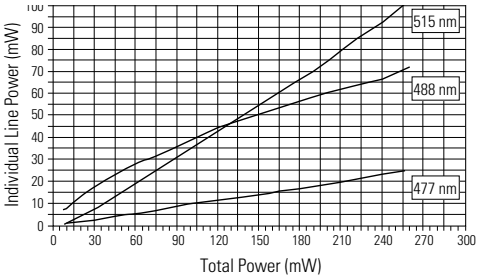
Common Environmental Specifications

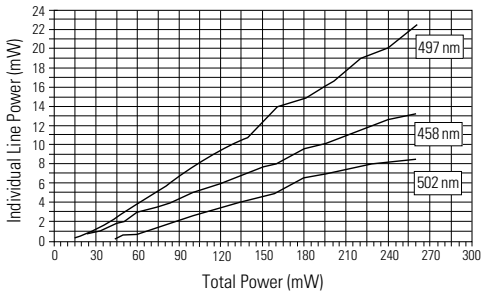
	Operating	*Non-operating*
Temperature	4° C to 40° C	-30° C to 60° C
Altitude	0 to 10,000 feet	0 to 70,000 feet
Relative Humidity (without condensation)	0 to 90%	0 to 100%
Shock	25 g for 11 msec	25 g for 11 msec

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Output Power of the Individual Lines of a Multiline Laser

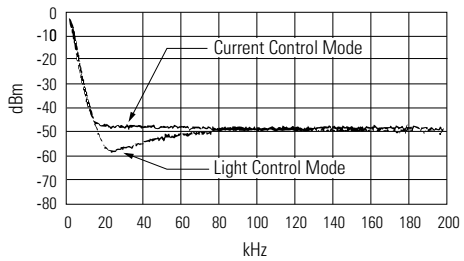
As many as six lines can lase simultaneously in a multiline laser. The graphs below display, on the vertical axes, the output power of the individual lines as a function of the total combined output power, shown on the horizontal axes.

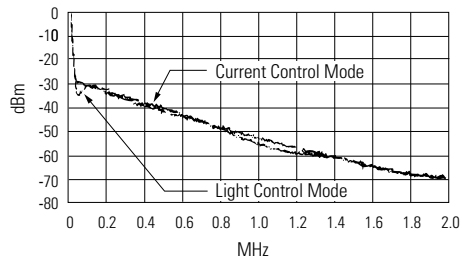




Noise Spectrum of Argon Ion Laser

The typical noise spectrum of an argon ion laser is shown in the graphs below. One trace is produced with the laser in current mode, and the second trace is produced in light mode. The traces in the upper graph illustrate the effectiveness of the light control loop canceling noise in the 20-Hz to 50-kHz range. The traces in the lower graph illustrate the noise spectrum from 20 Hz to 2 MHz.





2010 Series Options

Model Number Breakdown

2214–100MLM

- M-multimode (no M-single mode)
- SL-single line operation at 488 nm
- GL-green line operation at 515 nm
- BL-blue line operation at 458, 476, 488, and 497* nm
- ML-multiline operation at 458, 476, 488, 497, 502, and 515 nm
- VL-violet line operation at 458 nm
- output power in mW (see Output Power Specifications table)
- model number of head
  - first digit:
    - 2 = argon
  - second digit:
    - 0 = system
    - 1 = power supply
    - 2 = laser head
  - third digit:
    - 0 = last generation
    - 1 = new 2010 generation
  - fourth digit:
    - 1 = medium power, rectangular package
    - 2 = low power, cylindrical package
    - 3 = high power, cylindrical package
    - 4 = medium power, cylindrical package

* wavelength may not be present

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Model 2011 Argon Ion Laser System

The Model 2011 argon ion laser system consists of a Model 2211 head incorporating a 2311 argon ion laser tube, powered by a 2111 power supply.

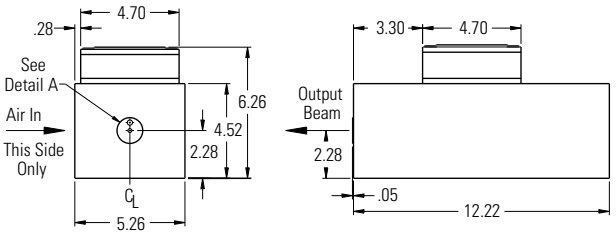
In the Model 2211 argon ion laser head, the Model 2311 laser tube is packaged with a heat exchanger and start circuit in an industry-standard rectangular housing. The mounting of the plasma tube in the housing facilitates replacement and provides thermomechanical isolation. The base plate has a variety of hole patterns, enabling users to replace other manufacturers' products without modifying their systems.

The proprietary integral-mirror, metal-ceramic design of the Model 2311 argon ion laser tube eliminates failures caused by contamination of the intracavity optics.

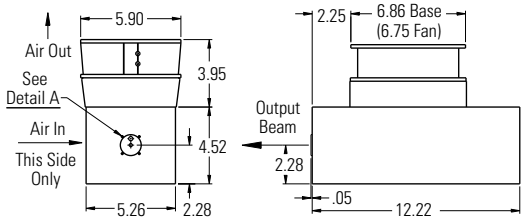
All intracavity optics are sealed inside the laser tube, ensuring that they will be cleaned by the high-temperature bake-out during vacuum processing and thereafter never be exposed to contaminants. The need to clean laser optics in the field is completely eliminated.

The long life and hands-off operation of the 2011 laser system are well documented, with tens of thousands of units in the field.

Model 2211 Laser Head

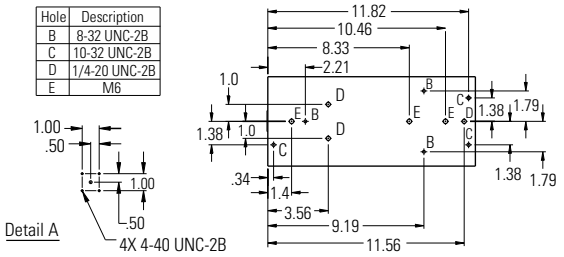


Dimensions above are for the following dash numbers: 10SL, 20SL, 10GL, 15GL, 10BL, 20BL, 25ML, 40ML, 4VL, 5VL



Dimensions above are for the following dash numbers: 30SL, 20GL, 30BL, 65ML, 100MLM, 6VL

Hole	Description
B	8-32 UNC-2B
C	10-32 UNC-2B
D	1/4-20 UNC-2B
E	M6



Notes:

Dimensions in inches.

E-vector is located in the vertical plane. Beam is located within 0.02 inch of 2.28 inch dimension and parallel to centerline of the head within 5 milliradians.

Model 2012 Argon Ion Laser System

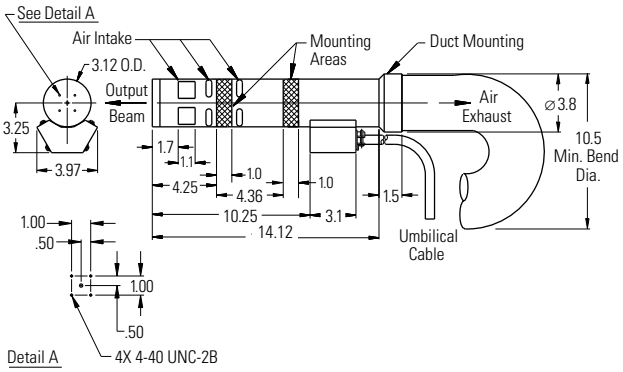
The Model 2012 argon ion laser system consists of a Model 2212 head incorporating a 2312 argon ion laser tube, powered by a 2112 power supply.

In the Model 2212 argon laser head, a Model 2312 laser tube is packaged in a cylindrical housing. The 2312 tube offers the proven integral-mirror, metal-ceramic technology in a smaller design with shorter discharge, combined with cost-efficient electronics. It offers unequaled price/performance.

The symmetrical design and axial airflow of the 2212 laser head provide the best mechanical package for eliminating transverse thermal gradients. Mounting the cylindrical laser in a system and replacing it in the field are straightforward operations. Fan vibration is eliminated by mounting the fan separately from the head and by moving air through a flexible duct.

The 2212 laser head demonstrates fast thermal response and superior resonator stability. Users can maintain the system in a low-current standby mode, then switch to the preprogrammed operating power in milliseconds through a remote interface in the power supply. This provides the same life-extending benefits found in the 2011 system.

Model 2212 and Model 2214 Laser Heads



Notes:

Dimensions in inches.

Model 2212 Laser Head Notes

E-vector is aligned with the umbilical cable.

Beam is centered to outer cylinder to within 0.02 inch and parallel to the outer cylinder within 5 milliradians.

Nominal air flow is 35 CFM. Use Dayton Model 4C442 or equivalent fan rated for 140 CFM free air and typical pressure head of 0.95 inch of water.

Model 2214 Laser Head Notes

E-vector is aligned with the umbilical cable.

Beam is centered to outer cylinder to within 0.02 inch and parallel to the outer cylinder within 5 milliradians.

Models 2014 -10SL, -20SL, -10GL, -15GL, -10BL, -20BL, -25ML, -40ML: Nominal air flow is 52 CFM. Use Dayton Model 4C442 or equivalent fan rated for 140 CFM free air and typical pressure head of 0.95 inch of water.

Models 2014 -30SL, -20GL, -30BL, -65ML, -4VL, -5VL, -6VL, -100MLM: Nominal air flow is 65 CFM. Use Model INB412 McLean Engineering or equivalent fan rated for 185 CFM free air and typical pressure head of 1.8 inches of water.

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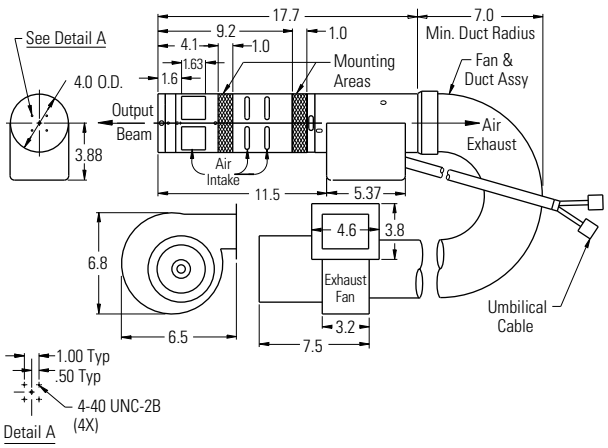
Model 2013 Argon Ion Laser System

The Model 2013 argon ion laser system consists of a Model 2213 head incorporating a 2313 argon ion laser tube, powered by a 2113 power supply.

For the 2313 laser tube, the proprietary technology developed for the Model 2311 laser tube was scaled up for a new, high-performance product. The resulting Model 2313 argon ion laser tube has demonstrated the same lifetime advantages and performance as the 2311. Now users with TEM_{00} multiline power requirements can get long lifetime and hands-off operation at 150 mW, and users with multiline, multimode applications can operate at 300 mW for extended periods of time.

As in the 2012 system, the symmetrical design and axial airflow of the Model 2213 head provide the best mechanical package for eliminating transverse thermal gradients. Mounting the cylindrical laser in a system and replacing it in the field are both straightforward operations. Fan vibration is eliminated by mounting the fan separately from the head and by moving air through a flexible duct.

Model 2213 Laser Head



Notes:

Dimensions in inches.

E-vector is aligned with the umbilical cable.

Beam is centered to outer cylinder to within 0.02 inch and parallel to the outer cylinder within 5 milliradians.

Nominal air flow is 115 CFM. Use Model 1NB412 McLean Engineering or equivalent fan rated for 185 CFM free air and typical pressure head of 1.8 inches of water.

Model 2014 Argon Ion Laser System

The Model 2014 argon ion laser system consists of a 2214 laser head incorporating a 2314 argon ion laser tube, powered by a 2114 power supply.

The 2214 laser head is a cylindrical version of the Model 2211 laser head. The acceptance of cylindrical packages in the Model 2012 and Model 2013 laser systems prompted Uniphase to develop the Model 2314 tube for incorporation into a cylindrical head. The 2314 is virtually identical to the 2311 except for the hardware for mounting the tube in the cylinder.

The symmetrical design and axial air flow provide the user with the same benefits as the 2212 and 2213 heads: elimination of transverse thermal gradients, ease of mounting and field replacement, and elimination of fan vibration. The 2214 head makes all the benefits of the 2211 laser head available in a convenient cylindrical package.

Mounting the cylindrical laser in a system and replacing it in the field are both straightforward operations. Fan vibration is eliminated by mounting the fan separately from the head and by moving air through a flexible duct.

For system dimensions see the Model 2012 laser system on the previous page.

2110 Series Power Supplies

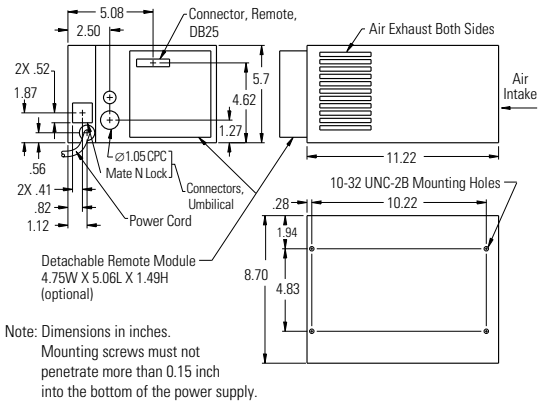
The 2110 Series power supplies are high-efficiency (>90%) switching-regulated power supplies with active filter technology[1] for ultralow noise operation. Active filter technology is a very low-loss, wide-bandwidth modulation technique that reduces noise by a factor of four when compared to last-generation power supplies. 2110 Series power supplies can be operated from standard voltage sources throughout the world without a transformer. Remote-control input/outputs are provided for the laser power monitor, tube current monitor, remote safety interlock, laser power adjust, and standby mode.

The Models 2111, 2112, and 2114 power supplies can operate from single-phase 100–240 Vac power sources.

The Model 2113 power supply can operate from single-phase 200–240 Vac power sources.

[1] Active filter technology is patented: U.S. Patents #4,910,654; 4,959,606; and 5,003,456.

Models 2111, 2112, 2113, and 2114 Power Supply



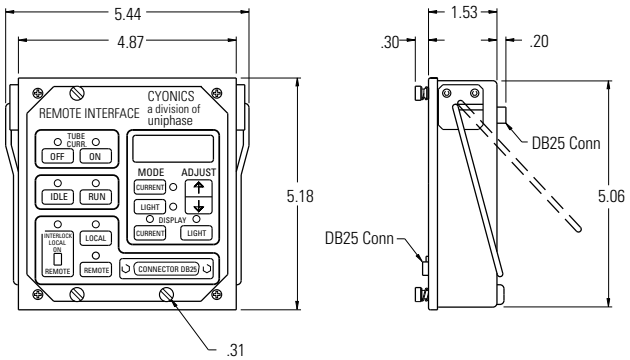
Note: Dimensions in inches.
Mounting screws must not penetrate more than 0.15 inch into the bottom of the power supply.

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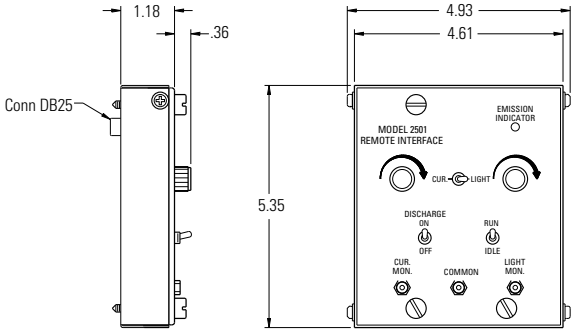
Remote Interface Controllers

The Model 2500 Series remote interface controllers (Models 2499, 2500, and 2501) allow the user to monitor and control output power and tube current from the remote interface of the 2111, 2112, 2113, and 2114 power supplies. The 2500 controller can be used while the host system is connected to the power supply via the remote interface. The 2500 has a liquid crystal display. The 2501 is a lower-cost version that has test points for a DVM to monitor the output power and tube current. The 2499 is the printed circuit board from inside the 2501.

Model 2500 Remote Interface Controller



Model 2501 Remote Interface Controller



Remote Interface Description

Function	*Pin Numbers*	*Comments*
Laser Output Power Control*	Pin 7 Apply + V	Apply 0 to 15 Vdc.
	Pin 11 Return	Calibration = 30 mV/mW. 10 kΩ input impedance.
Laser Current Control	Pin 6 Apply + V	Apply 0 to 6.5 Vdc.
	Pin 11 Return	Calibration = 0.5 V/A. 10 kΩ input impedance.
Laser Output Power Monitor*	Pin 8 + Output V	30 mV/mW.
	Pin 11 Return	0 to 12 Vdc.
Laser Current Monitor*	Pin 9 + Output V	0.1 V/amp.
	Pin 11 Return	0 to 1.3 Vdc.
Laser Idle/RUN	Pin 4 + Pin 11 Return	Pin 4 is at +15 Vdc for RUN. Ground for Idle. Pin 4 current is 3 mA (sink).
Laser Discharge On/Off	Pin 2 + Pin 11 Return	Pin 2 is at +15 Vdc for discharge ON. Ground for OFF. Pin 2 current is 0.15 mA (source).
Current or Light Control	Pin 5 + Pin 11 Return	Pin 5 is at +15 Vdc for light control. Ground for current control. Pin 5 current is at 3 mA (sink).
DC Power Supplies	Pin 13 = +15 Vdc	20 mA available.
	Pin 12 = -15 Vdc	20 mA available.
	Pins 10, 11, 14, 20 thru 22, and 24 are returns.	B Common.
Chassis Ground	Pin 25	
Interlock**	Pin 1 Pin 3	10 Vac, 100 mA shorted. These pins must be shorted before laser will operate.

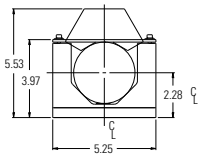
Note: There is a 40-second delay on power up or on discharge on.
* For the 300MLM, calibration = 10 mV/mW; for the 5VL, calibration = 100 mV/mW.
** In compliance with CDRH regulations, any breaking of the interlock circuit causes a permanent laser shutdown. To restart after re-establishing the interlock circuit, turn the ac main power OFF for approximately 10 seconds, then turn it back ON.
All electrical specifications are ±5%.

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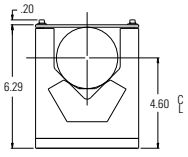
V-Block Mounts

Uniphase offers v-block mounts for cylindrical packages for ease of use in a laboratory environment or mounting in an OEM package.

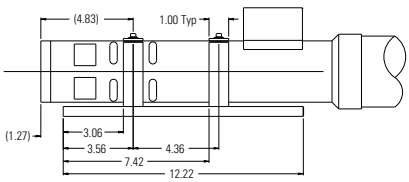
V-Block Mount for Model 2212 and Model 2214 Laser Heads

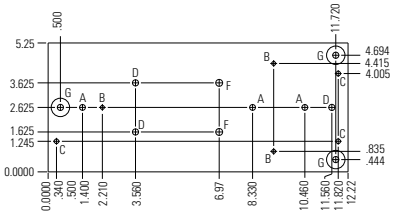


Small mount for 2212 or 2214:
Part number 006-038

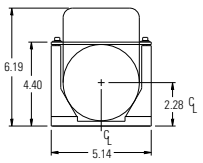


Large mount for 2212 or 2214:
Part number 006-039

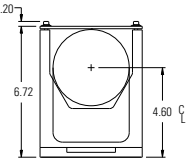




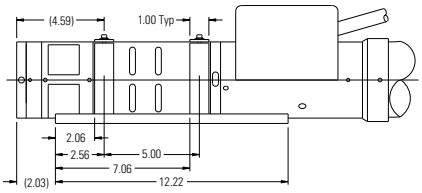
V-Block Mount for Model 2213 Laser Head

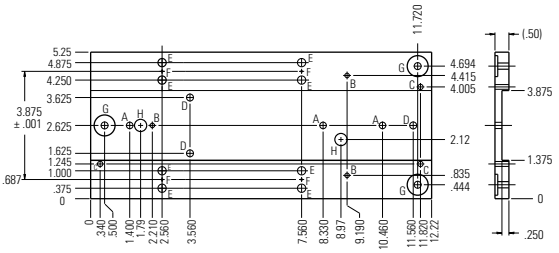


Small mount for 2213: Part number 005-980



Large mount for 2213: Part number 005-981



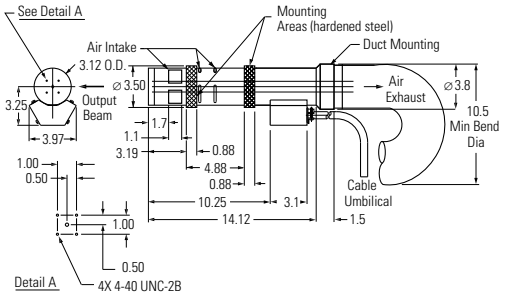


Note: Dimensions in inches.

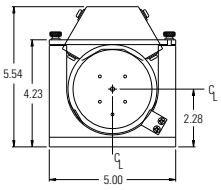
Precision Ring Options

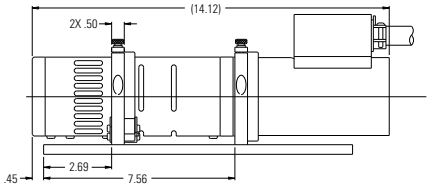
Most optical systems require precise alignment of the laser beam, and systems engineers have had to design adjustable mounts to allow field service engineers to align the laser. Uniphase offers the precision rings option for cylindrical laser heads. Two precision, ground stainless-steel rings are attached to the OD of the cylindrical laser housing, and the laser tube is positioned inside the housing within ±200 microradians of the centerline and within ±0.004 inch of the centerline at the output aperture. These tolerances will allow field interchangeability without adjustments in most optical systems.

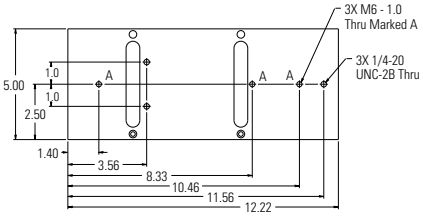
Model 2212 and Model 2214 Laser Head



V-Block Mount for Precision Ring Option on 2212 and 2214 Laser Heads







Part number 006-373 for Models 2212 and 2214

Note: Dimensions in inches.

Hole Chart		
Code	Description	Qty
A	M6	3
B	8-32 UNC-2B Thru	3
C	10-32 UNC-2B Thru	3
D	1/4-20 UNC-2B Thru	3
E	⌀ .180 Thru ⌴ ⌀ .297 ↧ .20	8
F	⌀ .128 +.002 -.000 Thru	4
G	1/4-20 UNC-2B Thru ⌴ ⌀ .75 ↧ .100	3
H	⌀ .438 Thru	2

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Weights

Model:	Weight (lbs):
2111	24
2112	24
2113	24
2114	24
2211	14
2212	8.2
2213	14
2214	8.5

Warranty

The 2311, 2312, 2313, and 2314 plasma tubes are warranted to be free from defects in materials and workmanship for 5,000 hours of operation at or below specified power or for 12 months from the date of shipment, whichever occurs first. All other components of the laser and power supply are warranted to be free from defects in materials and workmanship for 12 months from the date of shipment.

Licensing Information

Licensed by PATLEX Corporation under U.S. patent number 4,704,583.2010.

Patent Information

4,625,317 A thermal structure virtually free of thermal asymmetries using materials of high thermal conductivity and low thermal coefficient of expansion along the radial fins

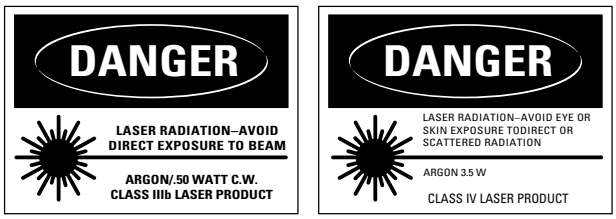
4,910,654 High-reliability current-limiting design for ac-coupled power supplies

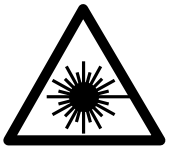
5,278,515 High-accuracy high-bandwidth (dc to one MHz) information channel with optoelectronic isolation

5,386,434 Internal mirror shield and method for protecting the mirrors of an internal mirror gas laser

Compliance to Regulatory Agencies

The argon ion laser heads and power supplies comply with CDRH Performance Standard 21CFR1040. The warning logotype shown below describes the CDRH classification and defines the operating limits.





Europe – IEC

Submission of new products to Underwriters Laboratory for approval against UL specifications 1950 and 1262 and submission to TUV Rheinland for approval against EN 60950 specifications is an ongoing commitment that Uniphase has made to serve our customers. The 2010 Series products have received CE certification per specifications EN55011 and EN50082-2.

Agency Approvals Common to All 2010 Series Argon Laser Systems

Electrical:
UL1262
CUL
EN60950, IEC 950 or EN61010

Laser Safety:
CDRH 21CFR1040
EN60825-1, -2

*For more information or to place an order, call **1-800-644-8674***

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