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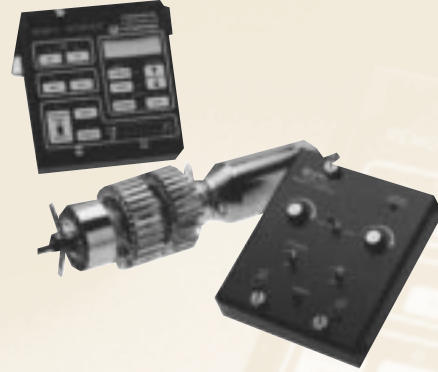
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# ARGON LASER SYSTEMS

- ◆ **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.

## 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 from 1.5 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 <sub>00</sub>	
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 <sub>00</sub>	
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 <sub>00</sub>	
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 <sub>00</sub>	
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 <sub>00</sub>	
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 <sub>00</sub> (mm @ 1/e <sup>2</sup> ±5%)	0.67
Multimode (mm @ 1/e <sup>2</sup> ± 15%)	1.0
Model 2012 System	
TEM <sub>00</sub> (mm @ 1/e <sup>2</sup> ±5%)	0.62
Model 2013 System	
TEM <sub>00</sub> (mm @ 1/e <sup>2</sup> ±5%)	0.65
Multimode (mm @ 1/e <sup>2</sup> ±15%)	1.0
Model 2014 System	
TEM <sub>00</sub> (mm @ 1/e <sup>2</sup> ±5%)	0.69
Multimode (mm @ 1/e <sup>2</sup> ±15%)	1.0
Beam divergence:	
TEM <sub>00</sub> (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)	5
(Model 2013, 15 minutes)	

### Input Power

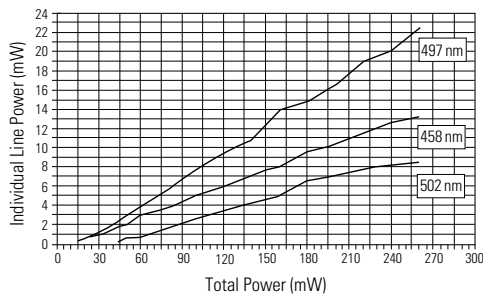
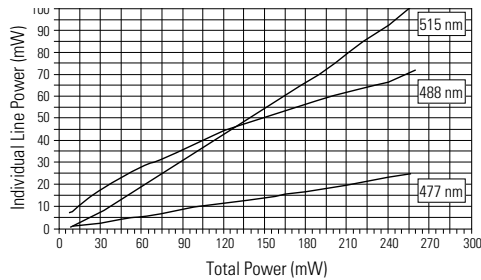
Voltage (Vac ±10%)	100, 120, 200, 208, 220, 240
Frequency (Hz)	47-63
Phase	Single
Maximum line current (A)	
with 2211 or 2214	20 17 12 12 10 10
-10SL, -20SL, -10GL, -15GL, -10BL, -20BL, -25ML, -40ML, -4VL, -5VL Heads	
with 2211 or 2214	23 19 13 13 12 11
-30SL, -20GL, -30BL, -65ML, -6VL, -100MLM Heads	
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	0 to 90%	0 to 100%
(without condensation)		
Shock	25 g for 11 msec	25 g for 11 msec

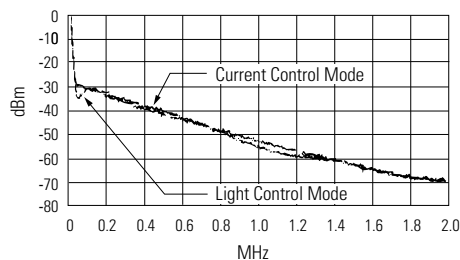
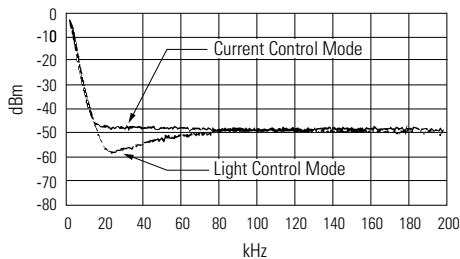
## Output Power of the Individual Lines of a Multiline Laser

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

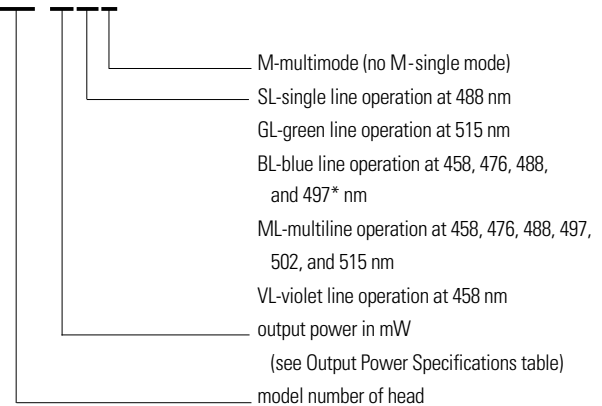
The typical noise spectrum of an argon ion laser is shown in the graphs below. One trace is produced with the laser in current mode, and the second trace is produced in light mode. The traces in the upper graph illustrate the effectiveness of the light control loop canceling noise in the 20-Hz to 50-kHz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



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

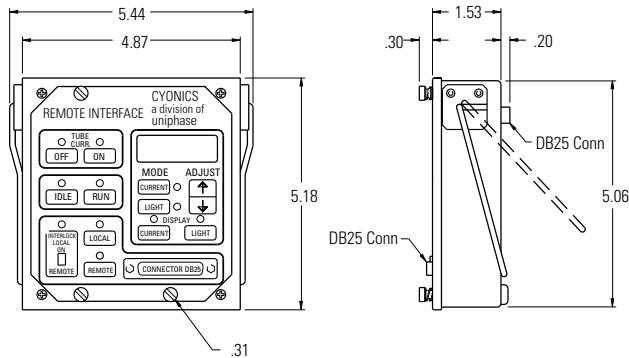




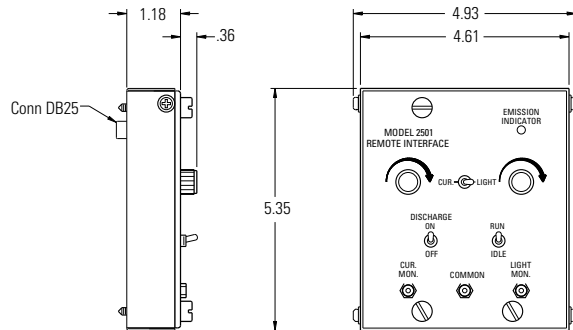
## Remote Interface Controllers

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 k $\Omega$ input impedance.
Laser Current Control	Pin 6 Apply + V	Apply 0 to 6.5 Vdc.
	Pin 11 Return	Calibration = 0.5 V/A. 10 k $\Omega$ 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 4 is at +15 Vdc
	Pin 11 Return	for RUN. Ground for Idle. Pin 4 current is 3 mA (sink).
Laser Discharge On/Off	Pin 2 +	Pin 2 is at +15 Vdc
	Pin 11 Return	for discharge ON. Ground for OFF. Pin 2 current is 0.15 mA (source).
Current or Light Control	Pin 5 +	Pin 5 is at +15 Vdc for
	Pin 11 Return	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,	B Common.
	20 thru 22, and 24	are returns.
Chassis Ground	Pin 25	
Interlock**	Pin 1	10 Vac, 100 mA
	Pin 3	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  $\pm 5\%$ .

## V-Block Mounts

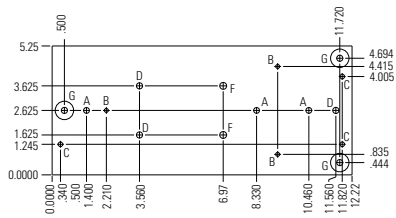
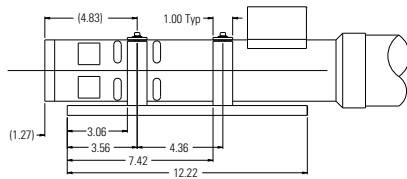
Uniphase offers v-block mounts for cylindrical packages for ease of use in a laboratory environment or mounting in an OEM package.

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

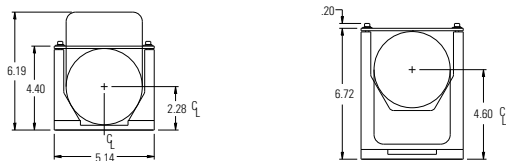


Small mount for 2212 or 2214:  
Part number 006-038

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

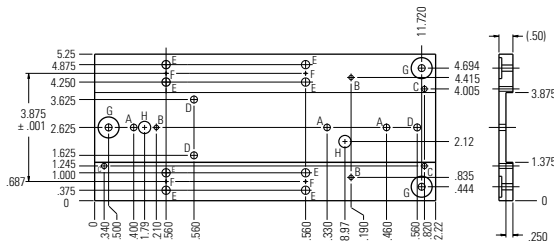
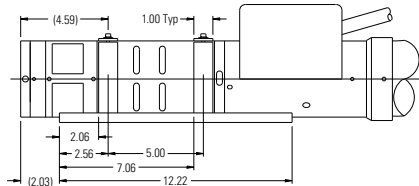


### V-Block Mount for Model 2213 Laser Head



Small mount for 2213: Part number 005-980

Large mount for 2213: Part number 005-981

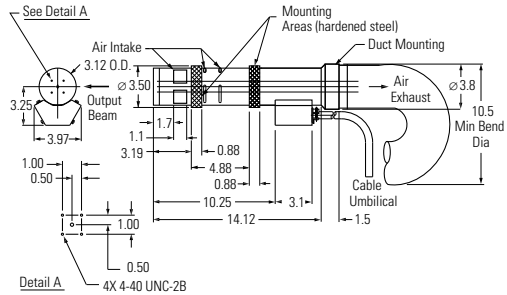


Note: Dimensions in inches.

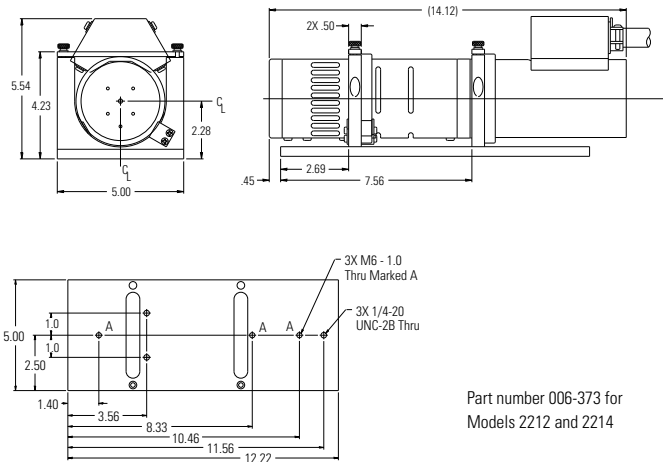
## Precision Ring Options

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  $\pm 200$  microradians of the centerline and within  $\pm 0.004$  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.

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



## 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

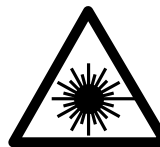
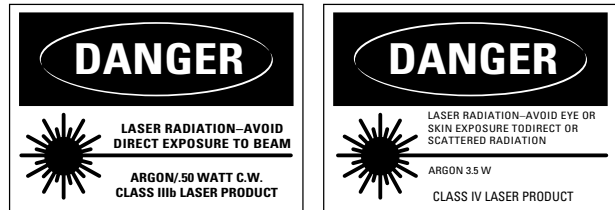
Licensed by PATLEX Corporation under U.S. patent number 4,704,583.2010.

## 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 TÜV 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:	Laser Safety:
UL1262	CDRH 21CFR1040
CUL	EN60825-1, -2
EN60950, IEC 950 or EN61010	



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