

CHAPTER² LASERS

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He-Ne LASERS



The Helium-Neon-lasers are designed for multi-purpose application, such as confocal laser scanning microscopy, spectroscopy, digital imaging, metrology, industrial measurements, positioning, alignment, aiming, testing, bar code scanning, medicine, science, education, entertainment, and so on. Customized solutions for specific application are optional.

Helium-Neon-laser tubes and modules are of robust mechanical design, excellent beam quality, long life up to 20,000 hours and optimum customer efficiency, with warranty up to 24 months for all standard types.

SPECIFICATION

Wavelength	633nm >95%
Mode Purity	TEM00 (Excluded AH050M & AH100M)
Max. Drift (mean power over 8 hrs)	± 5%
Max. Warm-Up Time (95% power)	15 minute

Mounting Option



See page 5-66

Model	Model	Model	Model	Model	Model	Model	Model	Model
AH005P	0.5mW	0.49mm	1.75mrad	200:1	1085 MHz	1.0%	20,000 hrs.	35 x 170
AH006R	0.6mW	0.49mm	1.7mrad	Random	1085 MHz	1.0%	20,000 hrs.	35 x 170
AH010R	1mW	0.49mm	1.7mrad	Random	1085 MHz	1.0%	20,000 hrs.	35 x 170
AH020R	2mW	0.75mm	1.2mrad	Random	614 MHz	1.0%	20,000 hrs.	35 x 280
AH020P	2mW	0.75mm	1.2mrad	500:1	614 MHz	1.0%	20,000 hrs.	35 x 280
AH050R	5mW	0.80mm	1.1mrad	Random	438 MHz	1.0%	20,000 hrs.	45 x 400
AH050P	5mW	0.80mm	1.1mrad	500:1	438 MHz	1.0%	20,000 hrs.	45 x 400
AH050M ¹	5mW	1.40mm	4.5mrad	Random	614 MHz	0.5%	20,000 hrs.	35 x 280
AH100R	10mW	0.70mm	1.4mrad	Random	320 MHz	0.5%	20,000 hrs.	45 x 505
AH100P	10mW	0.70mm	1.4mrad	500:1	320 MHz	1.0%	20,000 hrs.	45 x 505
AH100M ¹	10mW	1.50mm	4.0mrad	Random	438 MHz	1.0%	20,000 hrs.	45 x 400
AH150R	15mW	1.00mm	1.0mrad	Random	257 MHz	1.0%	20,000 hrs.	45 x 637
AH150P	15mW	1.00mm	1.0mrad	500:1	257 MHz	1.0%	20,000 hrs.	45 x 637

NOTE1: Multi Mode.

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HIGH POWER He-Ne LASERS



High Power He-Ne lasers are ideal for applications requiring high speed scanning superior signal to noise ratio and high visibility beams over long distances. Bezel accessory is required for use with any of our laser accessories. All lasers are tested to meet demanding lifetime, performance, and quality standards along with CDRH and IEC laser safety requirements. Laser housings are rugged aluminum, with a mechanical shutter at the output end. The single mode outputs of all laser offer high signal/noise ratios and consistent Gaussian beams, which are highly efficient for coupling into delivery systems. Polarization versions are for phase and orientation sensitive applications. Power supplies have key locks, on/off indicator, 3.5 to 7 second time delay, and remote interlocks. All power supplies are included.

SPECIFICATION

Wavelength	633nm
Mode Purity	>95% and >90%(AH350P), TEM ₀₀ Single Mode
Max. Noise	1.0% (RMS, 30Hz to 10MHz)
Max. Drift	2.0% (mean power over 8 hrs.)
Max. Warm-Up Time (95% power)	20 minutes, 60 minutes (AH350P)
Operating Temperature	10°C to 40°C
Non-Operating Temperature	-30°C to 60°C
Dimensions(mm),pourr supply excluded	AH180,AH200: Laser Head: 45 dia. x 637 length AH250, AH300: 1020 x 92.5 x 91.2 AH280: 979.5 x 80.5 x 93 AH350: 1029.97x78.74x75.57

Mode	Min Output (TEM00)	Beam Diameter (1/e2)	Beam Divergence (TEM00,)	Minimum Polarization Ratio	Longitudinal Mode Spacing (nomina)
AH180R	18.0mW	1.0mm	1.0mrad	Random	257MHz
AH180P	18.0mW	1.0mm	1.0mrad	500:1	257MHz
AH200R	20.0mW	1.0mm	1.0mrad	Random	257MHz
AH250P	25.0mW	1.25mm	0.8mrad	1000:1	165MHz
AH280P	28.0mW	1.25mm	0.8mrad	1000:1	165MHz
AH300P	30.0mW	1.25mm	0.8mrad	1000:1	165MHz
AH350P	35.0mW	1.23mm	0.66mrad	500:1	165MHz

Mounting Option



EL01A
See page 5-66



EP02R-EP04R
See page 5-72



EMB01 **EMB01A**
See page 5-79

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COLORED He-Ne LASERS

5-COLOR TUNABLE He-Ne LASER



- Operates at 543nm, 594nm, 604nm, 612nm, and 633nm
- Excellent Power, Beam Point & Thermal Stability

The 5-color tunable laser is ideal for applications requiring multiple wavelength references for calibration and as a general-purpose visible tunable light source for optical testing. It is the only commercially available multi-line HeNe laser that offers selectable operation. It operates on all of the main visible neon laser transitions (543nm, 594nm, 604nm, 612nm, and 633nm), a feature that makes it a versatile and economical research tool. The system uses a low loss plasma tube with one sealed Brewster window and an external Littrow prism. By adjusting the angle of the Littrow with micrometer adjustments on the rear panel, the user can select among the five wavelengths. A power supply is housed internally in the laser, making the unit completely self-contained.

AH100C

Maximum Output Power	15.0mW
Wavelength	633 / 612 / 604 / 594 / 543nm
Minimum Output Power	4.0 / 2.5 / 0.5 / 0.6 / 0.3mW
Mode Structure	TEM ₀₀
Polarization	Linear >500:1
Longitudinal Mode Spacing	428MHz
Beam Drift After 20 Min. Warm-Up	<0.2mrad
Long Term Beam Drift	<0.05mrad

COLORED He-Ne LASERS



- Green(543.5 nm), Yellow(594 nm), Orange(611.9 nm), IR(1523 nm) 5-color multiline
- Low Noise Without Reduced Lifetime
- Improved Beam Pointing Stability
- Long Term Amplitude Stability

GREEN LASER (543.5 nm)

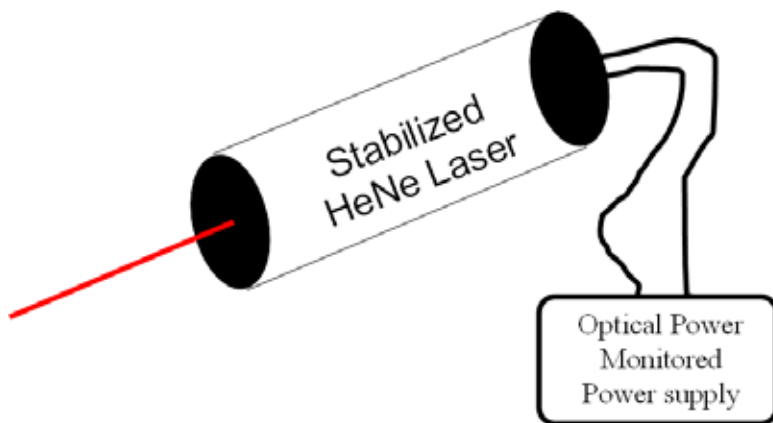
Model	Output Power (TEM ₀₀)	Beam Diameter @1/e ²	Beam Divergence	Polarization
AHX0XXX	0.2 ~ 2.0 mW	< 0.86 mm	< 1.26 mrad	Random or Linear
AHX0XXX	0.35 ~ 2.0 mW	< 0.8 mm	< 1.26 mrad	Random or Linear
AHX0XXX	0.5 ~ 2.0 mW	< 0.75 mm	< 1.26 mrad	Random or Linear
AHX0XXX	0.5 ~ 2.0 mW	1.26 mrad	1.59 mrad	Random or Linear

AHX0XXX

— Polarization P or R
— output Power X.X mW
— color: G(Green), Y(Yellow), O(Orange), R(Infrared)

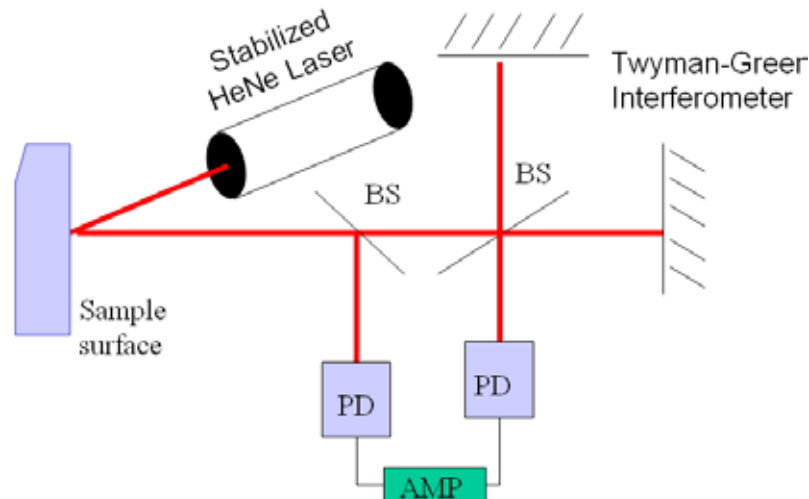
CHAPTER 2 LASERS

STABILIZED He-Ne LASER



- Compact size
- Power supply included
- Class II to Class IIIa

Application



The stabilized helium neon laser system produces two orthogonally polarized longitudinal modes. Modes move through the gain curve, changing in both frequency and amplitude as the laser cavity length changes. The two modes are separated into two beams by polarization lights, and their amplitudes are compared electronically. The cavity length is then adjusted to maintain the proper relationship between the modes that results in only one beam is allowed to exit the system.

Beam Diameter ($1/e^2$) (mm)	Beam Divergence ($1/e^2$) (mrad)	cw Output Power (mW)	Wavelength (nm)
~0.5	< 2.0	< 1.5	633

CHAPTER 2 LASERS

210 AIR-COOLED ARGON LASER SYSTEM



- Superior Beam Quality
- Low Noise
- Internal Mirror Design
- Extended Lifetimes
- Designed for Fiber Optic Delivery
- Exceptional Warranty

The 210 Argon laser has been engineered to meet today's most demanding needs in OEM applications. Offered in an industry standard rectangular package, the 210 provides unparalleled beam quality that is constant across output power levels and through fiber delivery systems. The 210 also offers improved thermal stability, longer life and exceptionally low noise. Quality The 210 draws upon years of experience and proven results with major OEM's worldwide. Utilized in life science, image recording and research applications, the 210 has effectively proven to reduce warranty returns and increase lifetimes.

APPLICATIONS

- Flow Cytometry
- Spectroscopy
- Photo Finishing
- DNA Sequencing
- Hematology
- Ultra High Speed Laser Printing
- Confocal Microscopy
- Medical Detection Equipment
- Graphic Arts
- Semiconductor Inspection
- Basic Research

Product Specifications ^{1,2,3}	210DB	210BL	210GL	210AL
Wavelength	458nm	488nm	514nm	458-514nm
Output Power	5mW	15,20,30mW	10,15,20mW	25,40,65mW
Power Stability (over 2 hours)	±1%	±1%	±1%	±1%
Spatial Mode	TEM ₀₀	TEM ₀₀	TEM ₀₀	TEM ₀₀
M ²	<1.2	<1.2	<1.2	<1.2
Beam Diameter @ 1/e ² (mm)	0.63±5%	0.65±5%	0.67±5%	0.67±5%
Beam Divergence (mrad)	<1.0	<1.0	<1.0	<1.0
Polarization Ratio	>250:1	>250:1	>250:1	>250:1
Pointing Stability over 2 hours (μrad)	±30/±3°C	±30/±3°C	±30/±3°C	±30/±3°C
Noise (20Hz - 2kHz peak to peak)	0.1%	0.1%	0.1%	0.1%
Noise (20Hz - 20kHz peak to peak)	1.0%	1.0%	1.0%	1.0%
Noise (20Hz - 2MHz rms)	1.0%	1.0%	1.0%	1.0%

Operating Parameters

Voltage (Universal Input)	100-240VAC±10%
Current	16 Amps Max.
Frequency	47-63 Hz
Phase	Single
Air Intake (Standard, Large, Remote Cooling ⁴)	106, 225, 65 CFM
Air Intake Clearance	2.5cm (1in)
Operating Temperature / Humidity	4-40°C (40-105°F) / <90%
Storage Temperature / Humidity	-30-60°C (-22-140°F) / <100%
Warm-up Period	10 min.

Dimensions

Laser Head	12.69" x 5.26" x 6.3"
Power Supply	11" x 6.38" x 3.85"

Weights

Laser Head (Std, Lrg, Remote Fan) ⁵	10.8, 12.5, 9.5 lbs (4.9, 5.7, 4.3 kg)
Power Supply	7 lbs (3.18 kg)

Notes

- Specifications subject to change without notice.
- When used with 9400 series power supply.
- Measurements taken in light control after 5 minute warm-up.
- Nominal air flow is 65 CFM. Use McLean Engineering Model INB412 or equivalent fan rated for 185 CFM free airflow and 1.8 inches of water. Hose length not to exceed two meters.
- Large fan required for 30, 20, & 65mW @ 488, 514, & 458-514nm options.

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600 AIR-COOLED ARGON LASER SYSTEM



- Superior Beam Quality
- Low Noise
- Internal Mirror Design
- Extended Lifetime
- Designed for Fiber Optic Delivery
- Exceptional Warranty

The 600 Argon laser has been engineered to meet today's most demanding needs for the mid-power range in OEM applications. Designed in a rectangular package, the 600 provides unparalleled beam quality that is constant across output power levels and through fiber delivery systems. The 600 also offers improved thermal stability, longer life and low electronic and optical noise. The laser

APPLICATIONS

- Ultra High Speed Laser Printing
- DNA Sequencing
- Optical Disk Mastering
- Confocal Microscopy
- Flow Cytometry
- Spectroscopy
- Hematology
- Basic Research

Product Specifications ^{1,2,3}	600BL	600AL	600AM
Wavelength	488nm	458-514nm	458-514nm
Output Power	40mW	100mW	200mW
Power Stability (over 2 hours)	±1%	±1%	±1%
Spatial Mode	TEM ₀₀	TEM ₀₀	Multimode
M ²	<1.2	<1.2	
Beam Diameter @ 1/e ² (mm)	0.70±5%	0.75±5%	0.80±5%
Beam Divergence (mrad)	<1.0	<1.0	<2.4
Polarization Ratio	>250:1	>250:1	Random
Pointing Stability over 2 hours (μrad)	±30/±3°C	±30/±3°C	±30/±3°C
Noise (20Hz - 2kHz peak to peak)	0.1%	0.1%	0.1%
Noise (20Hz - 20kHz peak to peak)	1.0%	1.0%	1.0%
Noise (20Hz - 2MHz rms)	1.0%	1.0%	1.0%

Operating Parameters

Voltage (Universal Input)	200-240VAC±10%
Current	16 Amps Max.
Frequency	47-63 Hz
Phase	Single
Air Intake	216 CFM
Air Intake Clearance	2.5cm (1in)
Operating Temperature / Humidity	4-40°C (40-105°F) / <90%
Storage Temperature / Humidity	-30-60°C (-22-140°F) / <100%
Warm-up Period	10 min.

Dimensions

Laser Head	15.56" x 4.7" x 6.23"
Power Supply	11.3" x 6.38" x 5.58"

Weights

Laser Head	12.5 lbs (5.8 kg)
Power Supply	7 lbs (3.18 kg)

Notes

1. Specifications subject to change without notice.
2. When used with 8400 series power supply.
3. Measurements taken in light control after 5 minute warm-up.

CHAPTER 2 LASERS

800 AIR-COOLED ARGON LASER SYSTEM



- Superior Beam Quality
- Internal Mirror Design
- Designed for Fiber Optic Delivery
- Low Noise
- Extended Lifetime
- Exceptional Warranty

The 800 argon laser delivers a full 500mW of output power in multiline/multi-mode configuration as well as high output powers in the single line options. The 800 also offers improved thermal stability, longer life and low electronic and optical noise. The laser incorporates the latest in internal mirror tube technology assuring permanent beam alignment and eliminating contamination.

APPLICATIONS

- Flow Cytometry
- DNA Sequencing
- Confocal Microscopy
- Lightshows & Displays
- Spectroscopy
- Hematology
- Optical Disk Mastering
- Basic Research

Product Specifications ^{1,2,3}	800DB	800BL	800AL	800AM
Wavelength	458nm	488nm	458-514nm	458-514nm
Output Power	20mW	100mW	225mW	500mW
Power Stability (over 2 hours)	±1%	±1%	±1%	±1%
Spatial Mode	TEM ₀₀	TEM ₀₀	TEM ₀₀	Multimode
M ²	<1.2	<1.2	<1.2	
Beam Diameter @ 1/e ² (mm)	0.83±5%	0.85±5%	0.83±5%	0.83±5%
Beam Divergence (mrad)	<1.0	<1.0	<2.0	<2.0
Polarization Ratio	>250:1	>250:1	Random	Random
Pointing Stability over 2 hours (μrad)	±30/±3°C	±30/±3°C	±30/±3°C	±30/±3°C
Noise (20Hz - 2kHz peak to peak)	0.1%	0.1%	0.1%	0.1%
Noise (20Hz - 20kHz peak to peak)	2.0%	2.0%	2.0%	2.0%
Noise (20Hz - 2MHz rms) ⁴	1.0%	1.0%	1.0%	1.0%

Operating Parameters

Voltage (Universal Input)	200-240VAC±10%
Current	16 Amps Max.
Frequency	47-63 Hz
Phase	Single
Air Intake	450 / 250 CFM
Air Intake Clearance	3.8cm (1.5in)
Operating Temperature / Humidity	4-40°C (40-105°F) / <90%
Storage Temperature / Humidity	-30-60°C (-22-140°F) / <100%
Warm-up Period	10 min.

Dimensions

Laser Head	17.904" x 6.071" x 7.733"
Power Supply	11.3" x 6.38" x 5.58"

Weights

Laser Head	19.5 lbs (8.9 kg) / 14.5 (6.6kg)
Power Supply	7 lbs (3.18 kg)

Notes

1. Specifications subject to change without notice.
2. When used with 8400 series power supply.
3. Measurements taken in light control after 5 minute warm-up.
4. 1% for single line wavelengths. 2% for multiline wavelengths.

5. Nominal air flow is 250 CFM. Use Kooltronic Model KBB490r equivalent fan rated for 425 CFM free air flow and 2.7 inches of water. Hose length not to exceed three meters.

CHAPTER 2 LASERS

C61 AIR-COOLED ARGON LASER SYSTEM



- Superior Beam Quality
- Internal Mirror Design
- Designed for Fiber Optic Delivery
- Low Noise
- Extended Lifetime
- Exceptional Warranty

Cylindrical Design

The C61 argon laser has been engineered to meet today's most demanding OEM applications. Designed in an industry standard cylindrical package, the C61 minimizes vibration by utilizing remote cooling. The laser head was designed for quick field replacement and has been designed by NLC to offer tube replacement as well.

Beam Quality

The C61 provides unparalleled beam quality that is constant across output power levels and through fiber delivery systems. The laser incorporates the latest in internal mirror tube technology securing permanent beam alignment and eliminating contamination. The C61 also offers improved beam pointing stability, and low noise.

APPLICATIONS

- Photo Finishing
- Confocal Microscopy
- Medical Detection Equipment
- Graphic Arts
- Spectroscopy
- Basic Research
- Flow Cytometry
- Hematology
- DNA Sequencing
- Semiconductor Inspection

Product Specifications ^{1,2,3}	C61DB	C61BL	C61GL	CL61AL
Wavelength	458nm	488nm	514nm	458-514nm
Output Power	5mW	4,10,20,30mW	10,15mW	25,40,65mW
Power Stability (over 2 hours)	±1%	±1%	±1%	±1%
Spatial Mode	TEM ₀₀	TEM ₀₀	TEM ₀₀	TEM ₀₀
M ²	≤1.2	≤1.2	≤1.2	≤1.2
Beam Diameter @ 1/e ² (mm)	0.62±5%	0.65±5%	0.67±5%	0.67±5%
Beam Divergence (mrad)	<1.0	<1.0	<1.0	<1.0
Polarization Ratio	>250:1	>250:1	>250:1	Random
Pointing Stability over 2 hours (μrad)	±30/±3°C	±30/±3°C	±30/±3°C	±30/±3°C
Noise (20Hz - 2kHz peak to peak)	0.1%	0.1%	0.1%	0.1%
Noise (20Hz - 20kHz peak to peak)	1.0%	1.0%	1.0%	1.0%
Noise (20Hz - 2MHz rms)	1.0%	1.0%	1.0%	1.0%

Operating Parameters

Voltage (Universal Input)	100-240VAC±10%
Current	16 Amps Max.
Frequency	47-63 Hz
Phase	Single
Air Intake	65 CFM ⁴
Air Intake Clearance	2.5cm (1in)
Operating Temperature / Humidity	4-40°C (40-105°F) / ≤90%
Storage Temperature / Humidity	-30-60°C (-22-140°F) / ≤100%
Warm-up Period	10 min.

Dimensions

Laser Head	14.13" x 4" x 4.81"
Power Supply	11" x 6.38" x 3.85"

Weights

Laser Head	6.5 lbs (2.8 kg)
Power Supply	7 lbs (3.18 kg)

Notes

1. Specifications subject to change without notice.
2. When used with 8400 series power supply.
3. Measurements taken in light control after 5 minute warm-up.

CHAPTER 2

LASERS

He-Cd LASER

See **P1-103**
for Spectragraph

- Pointing Stability Better then 20 urad
- CE, IEC, CDRH and cTUVus Compliant

Specifications	
Wavelength (nm)	325, 442 or Dual Wavelength
Operating Humidity	0% to 90%, noncondensing
Operating Temperature	10°C to 40°C
Warm-up Time	<15 minutes from cold start
Output Power(mW)	2~130
Recovery from Standby	<5 minutes
Maximum Shock (in shipping container)	30 G
Nonoperating Temperature	-40°C to +60°C
Beam Diameter (1/e ²)(mm)	>2.9
Beam Divergence (1/e ²)(mrad)	>3.0

Product Type (Click Product Code)	Feature	Wavelength Range (nm)	Power Range (mW)
Small Frame	Hard sealed, single wavelength	442	30–130
Small Frame	Hard sealed, single wavelength	325	6–40
Small Frame	Hard sealed, single wavelength	325/442	5–35/20–100
Medium Frame	Hard sealed, single wavelength	325	20–50
Medium Frame	Hard sealed, single wavelength	325	2–18
Medium Frame	Hard sealed, single wavelength	325/442	2–15/10–35

CHAPTER 2 LASERS

CO₂ LASER



LASER HEAD:

- Front plate with 'hole pattern' to accept our beam delivery mechanism
- flow interlock switch
- cover interlock switch
- Adjustable height
- Any mounting position
- Add (2) mirrors and a lens to cover any size x-y gantry.

POWER SUPPLY:

- Key Switch
- ON/OFF switch
- 'brown-out' interlock switch
- Power level adj.
- Mounting position: any

External Controls:

- CW or 1 pps to 1000 pps
- Pulse duty cycle: 0 to 100%
- External computer control or foot switch *

* Foot switch not included

(A) Computer analog output required:

0-5 Vdc signal at 6 mA for ON/OFF

0-5 Vdc signal for Min to Max Power adjustment.

(B) Foot Switch:

Contact closure



Model	Output Power W	Output Power Range W	Spectral Structure	Beam Size@1/e ² mm	Beam Divergence mrad	Pulse Energy @<1ms	Dimension Laser Head/ Power Supply inch	Weight Laser Head/ Power Supply lbs
PLX35-S	35	5 to 35	TEM ₀₀	6	2.5	>90mJ	6 x 6 x 40/	11/9 19 x 7.8 x 6.3
PLX45-S	45	6 to 45	TEM ₀₀	6	2.5	>90mJ	6 x 6 x 40/	11/9 19 x 7.8 x 6.3
PLX50-S	50	10 to 50	TEM ₀₀	7	2.2	150 to 200mJ	6 x 6 x 53/	14/12 19 x 7.8 x 6.3
PLX60-S	60	10 to 60	TEM ₀₀	7	2.2	150 to 200mJ	6 x 6 x 53/	14/12 19 x 7.8 x 6.3
PLX70-S	70	10 to 70	TEM ₀₀	7	2.2	150 to 200mJ	6 x 6 x 53/	14/12 19 x 7.8 x 6.3
PLX80-S	80	30 to 85	TEM ₀₀	7	2.2	240 to 300mJ	6 x 6 x 65/	18/14 19 x 7.8 x 6.3
PLX90-S	90	30 to 105	TEM ₀₀	7	2.2	240 to 300mJ	6 x 6 x 65/	18/14 19 x 7.8 x 6.3
PLX100-S	100	30 to 105	TEM ₀₀	7	2.2	240 to 300mJ	6 x 6 x 65/	18/14 19 x 7.8 x 6.3

AMPLIFIED Ti:SAPPHIRE LASER SYSTEM



The CPA Series is the only fully integrated kHz Ti:Sapphire laser system on the market today. The turn-key nature of this extremely compact laser accentuates its

- Fully-integrated system including
 - o Telecom diode-pumped fiber oscillator with 20 year MTTF
 - o Pulse stretcher
 - o Regenerative amplifier
 - o KHz Nd:YAG pump laser
 - o Pulse compressor
 - o Built-in diagnostics
 - o Active hydrothermal stabilization
- Drift-free performance
- Transportable
- Ideal for pumping OPAs
- Ideal for micromachining

productivity and utility.

A truly No Tweak™ design, it will run for days without the need to periodically readjust it to optimize performance. The laser is a fully-integrated system that includes everything you need to generate high peak power femtosecond pulses in one box [i.e. seed laser and its associated diode laser pump, pulse stretcher, Ti:S regenerative amplifier and its associated pump laser, and pulse compressor].

	CPA-2101	CPA-2110	CPA-2161	CPA-2210
Femtosecond Version:				
Pulse Energy	>0.8 mJ @ 1 kHz	>1mJ @ 1kHz, > 0.6 mJ @ 1-2 kHz	Constant average power of 2.5W from 3 kHz to 6 kHz (Customer chosen factory setting).	>2 mJ @ 1kHz, >1.5 mJ@1-2 kHz
Pulse Width	<150 fs	<150 fs	<150 fs	<150 fs
TBWP	<1.4 x transform limit (sech2)	<1.4 x transform limit (sech2)	<1.4 x transform limit (sech2)	<1.4 x transform limit (sech2)
Picosecond Option:				
Pulse Energy	>0.6 mJ @ 1kHz			
Bandwidth	<8 cm-1			
TBWP	<1.2 x transform limit (gaussian)			
Oscillator Output Option 1:				
Wavelength	1550 nm	1550 nm	1550 nm	1550 nm
Power	10 mW	10 mW	10 mW	10 mW
Repetition Rate	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal
Oscillator Output Option 2:				
Wavelength	775 nm	775 nm	775 nm	775 nm
Power	3 mW	3 mW	3 mW	3 mW
Repetition Rate	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal
Oscillator Output Option 3:				
Wavelength	1550nm & 775 nm	1550nm & 775 nm	1550nm & 775 nm	1550nm & 775 nm
Power	7 mW @ 1550nm, 3 mW @775 nm	7 mW @ 1550nm, 3 mW @775 nm	7 mW @ 1550nm, 3 mW @775 nm	7 mW @ 1550nm, 3 mW @775 nm
Repetition Rate	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal	30 MHz, nominal
General:				
Wavelength	775 nm	775 nm	775 nm	775 nm
M2	<1.5	1.2 +/- 0.1	1.2 +/- 0.1	1.2 +/- 0.1
Repetition Rate	User adjustable up to 1 kHz	User adjustable up to 2 kHz	User adjustable up to 6 kHz	User adjustable up to 2 kHz
Polarization	linear, horizontal	linear, horizontal	linear, horizontal	linear, horizontal
Energy Stability	<1 % RMS	<1 % RMS	<1 % RMS	<1 % RMS
Beam Diameter (FWHM)	4-6 mm	4-6 mm	4-6 mm	4-6 mm
Physical Dimensions:				
Laser Head	48"L x 20"W x 12"H	48"L x 20"W x 12"H	48"L x 20"W x 12"H	48"L x 20"W x 12"H
Power Supply	24"L x 23"W x 38"H	24"L x 23"W x 38"H	24"L x 23"W x 38"H	24"L x 23"W x 38"H
Utility Requirements:				
Electrical	208 VAC, Single Phase, 50 or 60 Hz	208 VAC, Single Phase, 50 or 60 Hz	208 VAC, Single Phase, 50 or 60 Hz	208 VAC, Single Phase, 50 or 60 Hz
Water	Tap Water, 4 gpm, <20°C, >30 psi	Tap Water, 4 gpm, <20°C, >30 psi	Tap Water, 4 gpm, <20°C, >30 psi	Tap Water, 4 gpm, <20°C, >30 psi

CHAPTER 2 LASERS

20-WATTS AVERAGE POWER ULTRASHORT-PULSE LASER

- Direct diode-pumped Yb-fiberooscillator/amplifier design
- All-diode pumped, all-solid state construction
- Robust, one-box design
- >20 Watts Average Power @ 2 MHz repetition rate
- Repetition rate variable from 200 kHz to 25 MHz
- High beam quality
- Low noise, cw-pumped
- High stability and longevity
- Computer control
- Applications:
 - o Micromachining
 - o Photopolymerization
 - o Direct-write waveguides
 - o High S/N pump/probe
 - o OPA/NOPA pumping



The laser is an all-diode & direct-diode-pumped (A&DDP) Yb-doped fiber oscillator/amplifier system capable of producing variable pulse energies up to 10 microjoules at repetition rates between 500 KHz and 2 MHz. The repetition rate is further adjustable up to 25 MHz at a constant 20 watt average power output (i.e. reduced pulse energy above 2 MHz.) This average power is more than an order-of-magnitude higher than has traditionally been available in a one-box ultrashort pulse laser design.

The laser is based on a revolutionary new concept in mode-locked oscillator/amplifier technology. The use of a Yb-doped fiber-oscillator/fiber-amplifier design combines the low noise performance associated with solid state operation with the high mode quality of fiber lasers.

The laser is a source of femtosecond to picosecond pulses possessing the ease-of-operation, stability and reliability you would expect from a fiber source. Applications include multi-photon photopolymerization and waveguide writing, harmonic generation, and OPA/NOPA wavelength conversion for high S/N, and rapid data acquisition in pump/probe experiments.

*Repetition rate variable from single-shot to 500 KHz available as an option.

Performance Parameters

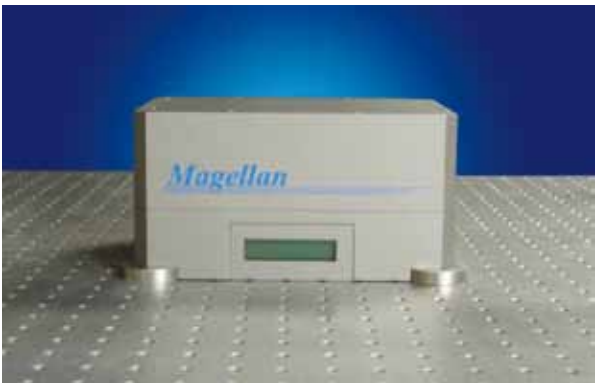
Repetition Rate:	User adjustable via computer from 200 kHz to 25 MHz ² (in increments of the oscillator repetition rate divided by a whole integer)
Pulse Energy:	User variable via computer between 100 nJ and 10 µJ (e.g. > 0.8 µJ @ 25 MHz, > 10 µJ @ < 2 MHz)
Average Power Output:	User adjustable via computer up to 20 Watts
Pulse Width:	User adjustable via computer between < 250 fs and > 8 ps
Transverse Mode:	TEM ₀₀ , M ² < 1.2 - 1.5 depending on pulse energy
Variation In Pulse Energy:	< 1% rms
Center Wavelength:	1.03 microns
Electrical:	110 VAC, 20 Amps
Dimensions:	Laser Head: 40.38" x 28.13" x 10.34" Control Cabinet: 32" x 22" x 49"

¹ Preliminary specifications. Subject to change without notice. Contact Clark-MXR, at sales@cmxr.com for further details.

² Optional pulse picker available to adjust repetition rate in the range of 200 kHz to single shot.

MAGELLANTM FEMTOSECOND/PICOSECOND FIBER OSCILLATOR

- Yb-doped fiber laser
- Single-element diode pump
- Compact, robust design
- Operates from 1.025-1.035 microns
- nJ level pulse energies
- Extremely low noise Free-space output port
- Ideal for
 - o OCT
 - o THz generation
 - o microscopy
 - o photopolymerization



Magellan is a Yb-doped fiber laser oscillator producing nJ level pulses at a wavelength of 1.03 microns. Magellan is able to deliver higher pulse energy from an oscillator without encountering non-linear effects that cause the pulse to degrade. Consequently, it is now possible to achieve up to a ten-fold improvement in power output from a source without having to incur the complexity of postpulse amplification. The result is a compact, robust source of picosecond or femtosecond pulses with the low noise, ease-of-operation, and reliability of a single-element, telecom-qualified, diode-pumped fiber oscillator. The standard configuration consists of a free-space propagating output port. Optional accessories will include extensions for OCT, THz generation, multi-photon microscopy and multi-photon photopolymerization.

Performance Parameters	
Femtosecond Version:	
Pulse energy:	> 1 nJ/pulse
Pulse width:	< 200 fs
Picosecond (Option):	
Pulse energy:	> 2 nJ/pulse
Pulse width:	~ 3 ps
General:	
Center wavelength:	fixed between 1.025-1.035 microns
Transverse mode:	TEM ₀₀
Repetition rate:	nominal 37 MHz
Average power output:	37 mW
Beam diameter:	1.8 mm +/- 0.2 mm
Beam divergence:	< 2 mrad
Dimensions:	225 x 160 x 117.28 mm
Electrical:	100- 240 Volts, 2 amps
Compressed Output	
Beam height	88.9 mm
Uncompressed Output	
Beam height	82.55 mm

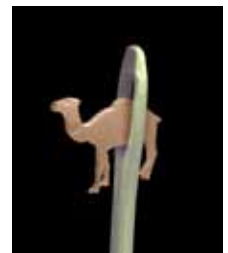
CHAPTER 2 LASERS

MICROMACHINING WORKSTATION

Fully-integrated system including:

- Field-proven laser source technology (Model CPA-Series)
- Multi-axis positioning system
- Beam delivery system
- Selection of processing parameters
- Class I enclosure
- Integrated, intelligent, on axis machine vision and inspection system
- Motion control
- Pulses "on-demand" (1, 2, ... 64,000 at user- selectable repetition rate)^a
- Optional Digital and/or Analog IO
- Complete computer control
- Granite base mounted on pneumatic
- vibration isolators
- Small footprint

Twenty years of experience with ultrashort pulse lasers combined with hundreds of real-world projects and years of processing know-how has led to our latest generation of femtosecond micromachining workstations. The UMW-Series includes everything you need to start micromachining with ultrashortpulsed lasers. This design benefits from our nine years of experience learning the right combination of components, performance parameters, and software needed to micromachine materials with ultrashort pulses of light. The Model UMW-Series provides ample space for custom beam delivery and manipulation, includes a sophisticated machine vision and inspection system, and complete computer control. The software interface provides powerful and intuitive access to all system functionality including the laser, motion, and machine vision systems and provides advanced intercommunication between them.



Made with a CPA-Series Ti:Sapphire Regenerative Amplifier

Performance Parameters

Positioning System: 1

X,Y Axis:

-Max Travel:	300 mm
-Repeatability:	0.5 μ m
-Accuracy	1.0 μ m
-Orthogonality	5 arc sec
-Max. Velocity	5 cm/sec

Z Axis:

-Max Travel	100 mm
-Repeatability	1.0 μ m
-Accuracy	+/- 1 μ m
-Max Velocity	5 cm/sec

Vision System:

Zoom Lens:	12x
Resolution: ²	1 μ m
Field of View: ²	4 mm
Lighting:	LED Ring and Coaxial Light
Inspection System:	Pattern recognition, edge location, part rotation, part measurement.

Laser:

(See Model CPA-2101, and CPA-2110 Brochures for performance parameters and features).

Enclosure:

Class I Laser Enclosure

a. TTL-0,+1 Δ T = 1/repetition rate

1. Values are for the base system. Other configurations are available upon request.

2. Resolution is for maximum magnification and depends on focusing objective, FOV is for minimum magnification.

CHAPTER 2 LASERS

DPSS LASER



- FEATURES
- Ultra-compact
 - Low noise
 - High efficiency
 - High reliability

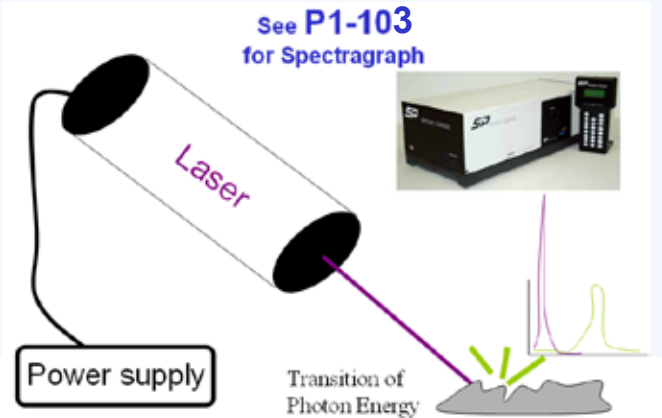
Onset provides ultra-compact diode-pumped crystal lasers with high reliability, high stability and high efficiency. The diode-pumped Crysta-Lasers are based on the proprietary coupled cavity laser technology. This patented technology allows the blue and infrared crystal lasers to operate in a single longitudinal mode and TEM00 mode with low amplitude noise and increasing the laser output in a compact housing with extremely low power consumption.

DPSS Laser Wavelength (nm)	Power	Power Stability	Application
266	1 mW ~ >10 W Varies with wavelength	1 % ~ 10 %	DNA sequencing, flow cytometry,cell sorting, instru- ment, spectrum analysis,interference, easurement, holography, laser printing, chip inspection, physics experiments etc. DNA sequencing, flow cytometry,cell sorting, instru- ment, spectrum analysis, interference, easurement, holography, laser printing, chip inspection, physics experiments etc collimation, laser medical treat- ment, scientific experimentation,optics instrument, laser display, laser lighting show, etc. experiment, sensing, measurement, instrument,communication, spectrum
355			
435			
457			
473			
480			
491			
500			
515			
523			
526			
532			
543			
556			
561			
589			
593			
656			
660			
671			
722			
914			
946			
1030			
1047			
1053			
1064			
1085			
1112			
1122			
1313			
1319			
1342			
1444			
1573			

Safety Options



See page 3-65



CHAPTER 2 LASERS

FIBER COUPLED LASER



The iFLEX2000™ is a compact laser diode system with a modular singlemode fiber delivery system. The laser is mode-hop free and wavelength stabilized as a direct result of active temperature control. A closed loop control provides long term power stability and an ability to monitor the power via an external output signal.

The laser module is guaranteed for long lifetime and delivers exceptional power stability with low amplitude noise. All models feature an interlock and output diagnostics for laser current and temperature as standard. Features include a high dynamic range 5MHz TTL modulation option or a variable power control via analog modulation up to 5MHz. All lasers feature diffraction limited output beams with zero astigmatism, high spatial coherence and low dynamic pointing error.

The iFLEX2000™ is compatible with a number of commercially available imaging software packages such as Olympus cell^R™, MetaMorph® and µManager and a number of add-on interfaces ensure a complete solution for all microscope systems.

The kinematic design of the laser to fiber coupler enables true 'Plug & Play' benefits for singlemode and polarization-preserving fiber designs. Sub-micron repeatability and sub-microradian stability mean systems can be 'factory set' and stable for multiple remove and insert operations. The laser and fiber systems are also optimized for unmatched laser modules thus providing true modularity for instrument design and ease of replacement.

Laser systems can be made available in constant current mode and in ultra-low noise versions. OEM options also include custom multiplexed laser modules with customer specific lasers.

Operating Wavelengths

Wavelength(nm)	405	445	473	488	640	660	670	780	830
Fixed Output Power(mw)	30	20	5	15,30	20,50	35,50	4	35	50

Technical Specifications

Operating Performance

Polarization ratio <-20dB

Laser Parameters

Center wavelength + 5nm

Power stability < 2% (over 8 hours)

N oise (20H z to 2M H z) < 0.1% rms

N oise (20H z to 20kH z) < 1% pk to pk

Electrical

Power Supply 12V DC,0.5A (laser)

5V DC,3A max,1 A running (TE Controller)

M ax. base plate temperature +40°C

Max.heat dissipation 12.5w

Connectorised output besm

Polarization maintaining fiber FCP,(polarization keyed) FCP8,APC (polarization keyed and 8 degree polished)

Fiber Parameters

Fiber length 1 to 3 meters

Fiber protective jacket Stainless steel,5mm OD

Collimated output beam

Beam diameter (mm) 0.7

M squared < 1.1

Pointing stability < 1µrad/°C

Operating humidity Beam divergence

M echanical dimensions Ø12 x 50mm

Beam position (mm) < +0.15

Beam angle (mrad) < +0.5

Environmental conditions

Storage temperature 10 to 50 °C

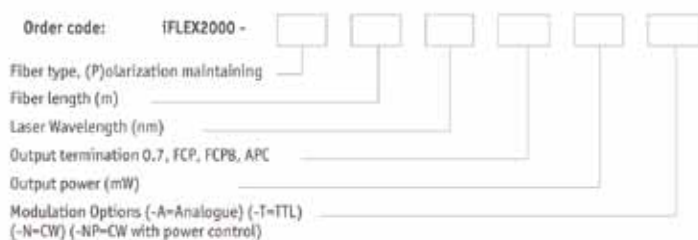
Operating pressure Atmospheric

Operating temperature 10 to 40 °C

Operating humidity N on-condensing

Modulation

Analog 5MHz, <200ns rise time, input voltage level 0 - 5V



LASER COMBINER MODULE



The iFLEX-Q3™ is a compact laser diode module with a small form laser head and remote electronics module. The laser is mode-hop free and wavelength stabilized as a direct result of active temperature control. A closed loop control provides long term power stability and an ability to monitor the power via an external output signal.

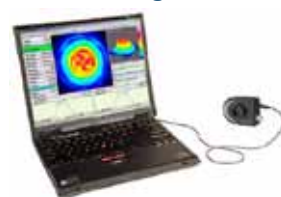
The diode laser system is guaranteed for long lifetime and delivers exceptional power stability with low amplitude noise. All models feature an interlock and output diagnostics for laser current and temperature as standard.

All lasers feature diffraction limited collimated output beams with elliptical profiles as standard. Customised options for circular beam profiles are available. A feature of this laser is low dynamic pointing error and precise static beam alignment tolerances.

The iFLEX-Q3™ is compatible with a number of commercially available imaging software packages such as Olympus cell^R™, MetaMorph® and µManager and a number of add-on interfaces ensure a complete solution for all microscope systems.

The laser has been designed for integrated measurement applications where a small optical head is required to deliver an exceptionally stable and precise laser beam. The highly polarized nature of the beam makes the laser ideal for scatter and reflection based measurement such as ellipsometry. Models at 375, 405, 445, 473, 488, 640, 660, 670, 780 and 830 nm deliver exceptional brightness and reliability for optical media inspection applications.

Beam Diagnostics



See page 1-120

Technical Specifications

Lasers											units
Wavelength	375a	405b	445a	473a	488b	640c	660c	670a	780d	830d	nm
Output power	15	50	40	10	50	35,100	60,100	8	60	100	mW
Centre wavelengths	± 5 nm										nm
Optical power stability	< 2% (over 8 hours)										-
Optical noise (20Hz to 2MHz)	< 0.1%rms*										-
Laser beam parameters											
Polarisation ratio	≤ -27 dB										dB
Beam diameter	a 2.2 (vertical) x 0.7 (horizontal)										mm
	b 2.1 (vertical) x 0.9 (horizontal)										
	c 1.6 (vertical) x 0.9 (horizontal)										
	d 2.0 (vertical) x 0.9 (horizontal)										
M squared	≤ 1.2*										-
Beam divergence	Diffraction limited										-
Beam position	≤ ±0.25										mm
Beam angle	≤ ±0.5										mrad
Pointing stability	≤ 5µrad/ °C										-
Mechanical, electrical and environmental											
Dimensions (laser head)	36 x 36 x 58										mm
Power supply (laser)	12 V DC, 0.5A										-
Power supply (TE controller)	5 V DC, 3A max, 1A running										-
Max. base plate temperature	+ 40 °C										°C
Max. heat dissipation	12.5										W
Storage temperature	10 to 50										°C
Operating pressure	Atmospheric										-
Operating temperature	10 to 40										°C
Operating humidity	Non-condensing										-

CHAPTER 2 LASERS

488nm SOLID STATE FIBER LASER



The iFLEX-Mustang™ is a fiber-coupled solid-state laser system with on-board acousto-optic modulation. The system operates at 488, 532 or 561nm and delivers 25mW of power from a singlemode fiber with a polarization extinction ratio of greater than 100:1.

The iFLEX-Mustang™ is supplied with the Point Source kineFLEX™ fiber delivery system which enables true 'Plug & Play' benefits with both sub-micron and sub-microradian repeatability and stability. The kineFLEX™ fiber features diffraction-limited output beams with zero astigmatism, high spatial coherence and low dynamic pointing error. The perfect TEM00 output beam is available with the option of collimated, divergent, circular or elliptical beams profiles.

The iFLEX-Mustang™ is manufactured with an on-board acousto-optic modulator operating in first order to ensure a modulation dynamic range of 30dB, modulation speed of 3 MHz and a rise and fall time of 350 ns.

The iFLEX-Mustang™ is compatible with a number of commercially available imaging software packages such as Olympus cell^R™, MetaMorph® and µManager and a number of add-on interfaces ensure a complete solution for all microscope systems.

With an operating wavelength of 488, 532 or 561nm the iFLEX-Mustang™ is ideal for use in biomedical instrumentation including confocal microscopes, flow cytometers and DNA sequencers and is also suitable for demanding specialised semiconductor metrology.

Order code: iFLEX-Mustang

Fiber type, (P)olarization maintaining

Fiber length (m)

Laser Wavelength (nm)

Output termination 0.7, FCP, FCP8, APC

Output power (mW)

Beam Diagnostics



See page 1-119

Technical Specifications

Lasers				
Wavelength	488	532	561	nm
Fiber coupled power	25	25	25	mW
Optical noise (20Hz to 2MHz)		< 0.3		%
Optical power stability		< 2% (over 4 hours)		-
Modulation speed		Upto 3MHz <350ns risetime, input voltage level 0-5V with a dynamic range of 30dB		-
Centre wavelengths		± 5		nm
Fiber delivery system				
Polarisation ratio		≤ -20		dB
Output termination		0.7 mm collimated, FCP, FCP8 or APC connectors		-
M squared		≤ 1.1		-
Beam divergence		Diffraction limited		-
Beam position (collimated beam)		≤ ± 0.15		mm
Beam angle (collimated beam)		≤ ± 0.15		mrads
Fiber protective jacket		Stainless steel, 5 mm OD		-
Fiber length		1, 2 or 3		m
Environmental				
Max. base plate temperature		+ 40		°C
Storage temperature		10 to 50		°C
Operating pressure		Atmospheric		-
Operating temperature		10 to 40		°C
Operating humidity		Non-condensing		-
Warranty				
5000 hours or 12 months (whichever comes sooner)				

DIODE LASER: Applications



Extend from the analytical to the biomedical. Our extensive selection of laser products can meet these challenges, providing users with the necessary tools to make their applications a success.

Analytical Applications:

A number of analytical applications have flourished with the help of our laser diode modules. Many have used distributed feedback (DFB) laser diodes in conjunction with our products to detect trace amounts of gases. In monitoring gas content in a critical manufacturing environment, such as an area in which semiconductor wafers are produced. They are perfect for analytical applications ranging from spectroscopy to interferometry to laser-induced fluorescence.

Industrial Applications:

Industrial users have discovered ingenious ways to employ laser products. A large aircraft manufacturer, is currently using one of our laser modules to assemble large sections of airliners to tight tolerances. Infrared lasers serve as ideal illumination sources for machine vision applications. It can also for drilling and marking applications.

Biomedical Applications:

MRI and x-ray patient alignment, cellular and tissue fluorescence, DNA analysis, particle and droplet sizing, flow cytometry, fluorescent microscopy, medical imaging, x-ray film marking, blood analysis, confocal microscopy, and as a pointing source for surgical lasers.

Safety Options



See page 3-65

CHAPTER 2 LASERS

PROJECT LASERS



Applications

- Machine Vision
- 3D Profiling
- Dimensional Scanning
- Road & Rail Inspection
- Fluorescence
- Illumination

Features

- Drop-in replacement for existing lasers
- Line generator with even intensity power distribution
- Optional collimated output
- Choice of Fan Angles: 10°, 20°, 30°, 45°, 60°, 90°
- ESD protection
- Over voltage protection

Power Technology, Inc. introduces laser modules designed expressly for Machine Vision applications including

3D Profiling & Mapping, Dimensional Scanning, High-Speed Road & Rail Inspection, Web Inspection and Fluorescence.

PNF lasers can deliver from 0.1mW to 200mW of output power with a wavelength range between 375nm and 2330nm. Additional de-sign features include uniform intensity (non-gaussian) line generators, unique Variable Focus™ Technology, high wavelength stability, high optical power stability, and CW or optional digital/analog modulation up to 100MHz.

The PNF boast the highest output power and fastest modulation

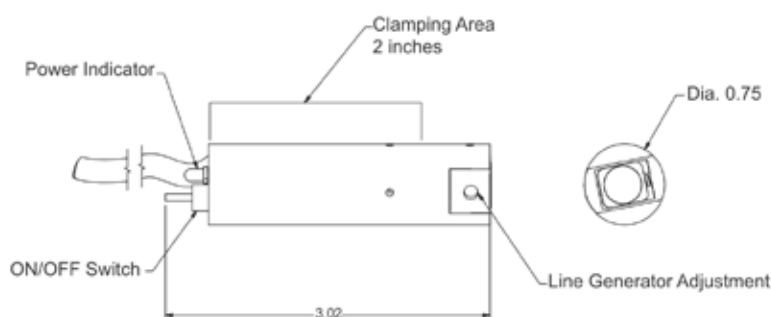
speeds of any similar laser module. The PNF Series of Machine Vision Lasers can be configured for optimal performance at close or long range. PTI's unique Variable Focus™ Technology allows the user to calibrate the focus of the module and then retune the line generator for optimal performance.

In addition, Power Technology, Inc. provides an array of custom design and manufacturing services. These services include high and low volume production, custom engineering, Customized connectors and beam profiling are available. Call your sales representative today.

Available Configurations:

Wavelength	Power
635nm	1,3,5,10,35,150 mW
650nm	1,5,10mW
660nm	20,30,35,50,100mW
670nm	5,10mW
685nm	30,50mW
690nm	35mW
705nm	40mW
780nm	5,50,75,100,120mW
810nm	50mW
830nm	30,50,150mW
850nm	5,30,50,150mW
980nm	25,50,100mW
1550nm	5mW

Specification	PNF Series
Wavelength (nm)	375nm - 2330nm
Output power (mW)	0.1mW - 200mW
Beam shape	Even Intensity Line Free Space Collimated
Available Fan Angles	10°, 20°, 30°, 45°, 60°, 90°
Output parameter	CW, Analog or Digital Modulation
Analog Modulation Rate	20MHz
Analog - rise time	>50 ns
Digital Modulation Rate	100MHz
Digital Rise Time	1-6ns
Operating voltage (VDC)	5
Maximum operating current (mA)	250
Temperature Range	-10 to +48° with Heatsink Option
Dimensions, Ø x L, in. / mm	0.75" x 3.02" 19.07mm x 77mm



CHAPTER 2 LASERS

DIODE LASER SELECTION CHART

Diode	Wave-length (nm)	Wavelength tolerance (nm) ¹	Power (mW)	Package (mm)	lop (mA)	Beam diverg.	Mode	PD config.	Source size	Max temp. °C ²	Diode data avail. [?]	Stock status ³	Warranty ⁴	Notes
LD1705	375	370-380	10	5.6mm	70	9 X 24	S	LDC to PDC	2 X 1	25°	Y	IN STOCK	180 DAYS	
LD1763	405	400-410	400	5.6mm	415	16 X 42	M	LDC to PDC	7 X 1	30°	Y	IN STOCK	1 Year	
LD1539	405	400-410	60	5.6mm	90	8 X 8	S	LDC to PDC	2 X 1	60°	Y	IN STOCK	1 Year	
LD1833	405	400-410	120	5.6mm	120	9 X 19.5	S	LDC to PDC	2 X 1	70°	Y	IN STOCK	1 Year	
LD1789	405	400-415	105	5.6mm	120	9 X 19	S	NO PD	2 X 1	30°	Y	IN STOCK	1 Year	
LD1510	405	400-415	60	5.6mm	90	8 X 22	S	LDC to PDC	2 X 1	30°	Y	IN STOCK	1 Year	
LD1788	405	400-415	20	5.6mm	50	9.5 X 20	S	NO PD	2 X 1	45°	Y	IN STOCK	1 Year	
LD1823	445	440-455	500	5.6mm	500	16 X 40	M	LDC to PDC	7 X 1	30°	Y	IN STOCK	180 Days	
LD1643	445	440-450	50	5.6mm	120	8.5 X 22	S	LDC to PDC	2 X 1	60°	Y	IN STOCK	180 Days	
LD1650	445	440-450	50	5.6mm	120	9 X 9	S	LDC to PDC	2 X 1	60°	Y	IN STOCK	180 Days	
LD1682	473	468-478	20	5.6mm	100	9 X 23	S	LDC to PDC	2 X 1	60°	Y	IN STOCK	180 Days	
LD1167	635	625-640	5	9mm	55	8 X 31	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1212	635	635-640	5	9mm	55	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	Internal Microlense
LD1477	635	625-640	10	9mm	55	8 X 31	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	Internal Microlense
LD1251	635	625-640	10	9mm	80	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1581	635	635-645	10	9mm	55	8 X 30	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1261	635	630-640	15	9mm	85	8 X 30	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1338	635	630-640	15	9mm	85	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	Internal Microlense
LD1159	635	635-640	3	9mm	45	8 X 35	S	LDA to PDC	3 X 1	5@40° or 3@50°	N	RS	1 Year	
LD1080	635	630-640	3	5.6mm	30	8 X 30	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1219	635	635-640	5	5.6mm	55	8 X 35	S	LDA to PDC	3 X 1	50°	N	RS	1 Year	
LD1234	635	635-640	5	9mm	40	8 X 35	S	LDA to PDC	3 X 1	50°	N	RS	1 Year	
LD1746	636	635-645	10	5.6mm	60	8 X 30	S	LDA to PDC	3 X 1	40°	Y	INQUIRE	1 Year	
LD1837	639	630-645	25	5.6mm	60	8 X 30	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1403	639	635-642	35	5.6mm	102	10 X 31	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1415	639	635-642	35	5.6mm	102	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1781	640	635-643	45	5.6mm	45	10 X 21	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1762	642	635-645	90	5.6mm	165	10 X 21	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1817	643	635-647	150	5.6mm	280	8 X 23	S	NO PD	3 X 1	50°	N	IN STOCK	1 Year	
LD1585	650	645-660	7	5.6mm	30	9 X 30	S	LDA to PDC	3 X 1	70°	N	IN STOCK	1 Year	
LD1350	650	640-660	7	5.6mm	60	8 X 8	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	Internal Microlense
LD1742	655	645-660	7	5.6mm	40	9.5 X 9.5	S	LDA to PDC	3 X 1	70°	N	IN STOCK	1 Year	
LD1241	658	640-665	35	5.6mm	90	8.5X22	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	
LD1240	658	640-665	35	5.6mm	90	8.5 X 8.5	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	Internal Microlense
LD1535	658	650-660	45	5.6mm	85	8 X 22	S	LDC to PDA	3 X 1	65°	N	RS	1 Year	
LD1598	658	652-662	90	5.6mm	145	10 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1649	658	650-662	50	5.6mm	115	9 X 21	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1747	658	651-665	40	5.6mm	65	10 X 16	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1691	658	650-665	40	5.6mm	65	10 X 16	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1630	658	650-662	50	5.6mm	115	9 X 9	S	NO PD	3 X 1	60°	N	IN STOCK	1 Year	
LD1507	658	652-662	70	5.6mm	110	10 X 17	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1508	658	650-662	70	5.6mm	110	10 X 10	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1658	658	654-662	100	5.6mm	170	10 X 10	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1628	658	654-662	100	5.6mm	170	9.5 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1578	658	650-660	45	5.6mm	85	10 X 10	S	LDC to PDA	3 X 1	65°	N	RS	1 Year	
LD1779	660	652-664	130	5.6mm	180	10 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1778	660	652-664	130	5.6mm	180	10 X 10	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1806	664	662-666	70	9mm	125	10 X 17	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1807	664	662-666	70	9mm	125	10 X 10	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1086	670	660-680	5	5.6mm	45	8 X 18	S	LDA to PDC	3 X 1	60°	Y	RS	1 Year	
LD1259	670	660-680	500	9mm	850	10 X 40	M	NO PD	100 X 1	50°	Y	INQUIRE	180 Days	
LD1248	670	660-680	10	9mm	55	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1220	670	660-680	10	9mm	70	8 X 18	S	LDA to PDC	3 X 1	50°	N	RS	1 Year	
LD1074	670	660-680	10	9mm	55	8 X 22	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1032	670	660-680	10	9mm	55	8 X 22	S	LDA to PDC	3 X 1	50°	Y	RS	1 Year	
LD1249	670	660-680	5	9mm	55	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1240	658	640-665	35	5.6mm	90	8.5 X 8.5	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	Internal Microlense
LD1535	658	650-660	45	5.6mm	85	8 X 22	S	LDC to PDA	3 X 1	65°	N	RS	1 Year	
LD1598	658	652-662	90	5.6mm	145	10 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1649	658	650-662	50	5.6mm	115	9 X 21	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1747	658	651-665	40	5.6mm	65	10 X 16	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1691	658	650-665	40	5.6mm	65	10 X 16	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1630	658	650-662	50	5.6mm	115	9 X 9	S	NO PD	3 X 1	60°	N	IN STOCK	1 Year	
LD1507	658	652-662	70	5.6mm	110	10 X 17	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1508	658	650-662	70	5.6mm	110	10 X 10	S	NO PD	3 X 1	70°	N	IN STOCK	1 Year	
LD1658	658	654-662	100	5.6mm	170	10 X 10	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1628	658	654-662	100	5.6mm	170	9.5 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1578	658	650-660	45	5.6mm	85	10 X 10	S	LDC to PDA	3 X 1	65°	N	RS	1 Year	
LD1779	660	652-664	130	5.6mm	180	10 X 17	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1778	660	652-664	130	5.6mm	180	10 X 10	S	NO PD	3 X 1	75°	N	IN STOCK	1 Year	
LD1806	664	662-666	70	9mm	125	10 X 17	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1807	664	662-666	70	9mm	125	10 X 10	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1086	670	660-680	5	5.6mm	45	8 X 18	S	LDA to PDC	3 X 1	60°	Y	RS	1 Year	
LD1259	670	660-680	500	9mm	850	10 X 40	M	NO PD	100 X 1	50°	Y	INQUIRE	180 Days	
LD1248	670	660-680	10	9mm	55	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1220	670	660-680	10	9mm	70	8 X 18	S	LDA to PDC	3 X 1	50°	N	RS	1 Year	
LD1074	670	660-680	10	9mm	55	8 X 22	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1032	670	660-680	10	9mm	55	8 X 22	S	LDA to PDC	3 X 1	50°	Y	RS	1 Year	
LD1249	670	660-680	5	9mm	55	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1183	670	660-680	5	5.6mm	45	8 X 18	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1084	670	660-680	5	5.6mm	35	8 X 30	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1710	670	660-680	5	5.6mm	30	9 X 9	S	LDA to PDC	3 X 1	70°	N	IN STOCK	1 Year	
LD1266	670	660-680	500	TO-3 w/ TEC	850	10 X 40	M	LDA to PDC	100 X 1	50°	Y	INQUIRE	180 Days	with TEC
LD1001	670	660-680	5	9mm	50	8 X 31	S	LDA to PDC	3 X 1	50°	N	RS	1 Year	
LD1748	685	682-686	50	5.6mm	100	9.5 X 20	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1318	690	680-695	35	5.6mm	90	8.5 X 19	S	LDC to PDA	3 X 1	70°	N	IN STOCK	1 Year	
LD1340	690	680-695	35	5.6mm	90	8 X 8	S	LDC to PDA	3 X 1	70°	N	IN STOCK	1 Year	Internal Microlense
LD1826	705	695-715	40	5.6mm	75	9 X 18	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1553	730	723-737	10	9mm	80	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1750	755	745-765	4	9mm	60	7 X 36	S	LDA to PDC	5 X 1	70°	N	IN STOCK	1 Year	
LD1687	760	759.5-761.5	40	9mm	80	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1686	760	759.5-761.5	40	9mm	80	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	

CHAPTER 2 LASERS

Please note!

1Wavelength is typically specified by diode manufacturers as +/-10nm, but some diodes may be specified at +/- 5nm or even +/- 20nm.

2Typical operating temperature range for visible diodes is -10° to 50°C and -10° to 60°C for infrared.

3In stock diodes are those that PTI stocks sufficient quantities of to meet most customers' immediate requirements. RS (remaining stock) diodes are those that we cannot or will not re-order once the present stock is depleted.

4Warranty periods shown are only for diodes incorporated into a module. Raw diodes (those not in a module) are sold without warranty and only if sufficient stock is available. Power Technology, Inc. reserves the right not to sell laser diodes at any time for any reason. Diode warranty of less than one year is a result of the diode manufacturer's limited warranty.

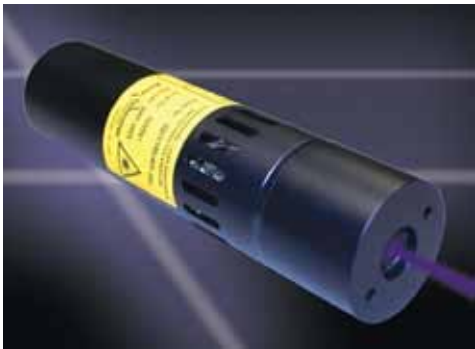
Diode	Wave-length (nm)	Wavelength tolerance (nm)1	Power (mW)	Package (mm)	Iop (mA)	Beam diverg.	Mode	PD config.	Source size	Max temp. °C2	Diode data avail.?	Stock status3	Warranty4	Notes
LD1569	763	762-764	50	9mm	120	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1589	763	762-764	50	TO-3 w/ TEC	120	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1570	773	772-774	75	9mm	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1637	773	772-774	75	TO-3 w/ TEC	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1558	780	773-787	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1571	780	779-781	80	9mm	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1557	780	773-787	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1556	780	773-787	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1646	780	779-781	80	TO-3 w/ TEC	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1638	784	779-781	100	TO-3 w/ TEC	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1572	784	783-786	100	9mm	150	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1480	785	770-800	80	5.6mm	110	8 X 8	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	
LD1227	785	782-788	1000	TO3	1300	10 X 40	M	LDA to PDC	100X1	50°	Y	IN STOCK	90 Days	
LD1596	785	780-787	120	5.6mm	133	9 X 9	S	No PD	3 X 1	65°	N	INQUIRE	1 Year	
LD1749	785	770-800	80	5.6mm	110	9 X 17	S	LDC to PDA	3 X 1	60°	N	INQUIRE	1 Year	
LD1534	785	780-787	120	5.6mm	133	8.7 X 16	S	No PD	3 X 1	65°	N	IN STOCK	1 Year	
LD1348	785	770-800	80	5.6mm	110	7 X 17	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	
LD1182	785	770-800	60	5.6mm	165	10 X 25	S	LDC to PDA	3 X 1	60°	Y	IN STOCK	1 Year	
LD1356	785	775-795	50	9mm	130	8 X 8	S	LDA to PDC	3 X 1	60°	N	INQUIRE	1 Year	
LD1231	785	775-795	50	9mm	130	9.5 X 23	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1235	785	770-800	25	5.6mm	70	9 X 25	S	LDA to PDC	3 X 1	60°	N	INQUIRE	1 Year	
LD1420	785	770-800	5	5.6mm	35	9 X 27	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1730	785	770-800	5	5.6mm	35	9 X 9	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1559	790	783-797	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1635	808	805-811	500	9mm	800	10 X 38	M	LDA to PDC	50X1	30°	Y	INQUIRE	180 Days	
LD1693	808	798-818	200	5.6mm	230	8 X 16	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1795	808	798-818	200	5.6mm	230	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1187	808	805-811	2000	TO3	2600	10 X 40	M	LDA to PDC	200X1	50°	Y	INQUIRE	90 Days	
LD1496	808	805-811	150	9mm	180	8 X 8	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1481	808	805-811	150	9mm	180	8 X 16	S	LDA to PDC	3 X 1	50°	N	IN STOCK	1 Year	
LD1560	808	800-815	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1177	808	805-811	500	TO3	800	10 X 38	M	LDA to PDC	50X1	50°	Y	INQUIRE	90 Days	
LD1202	808	805-810	1000	TO3	1300	10 X 40	M	LDA to PDC	100X1	50°	Y	INQUIRE	90 Days	
LD1428	810	800-820	100	9mm	200	9 X 9	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1181	812	807-819	1000	TO3	1300	10 X 40	M	LDA to PDC	100X1	50°	Y	INQUIRE	90 Days	
LD1200	812	807-819	500	TO3	750	10 X 40	M	LDA to PDC	50X1	50°	Y	INQUIRE	90 Days	
LD1751	816	806-826	4	9mm	56	7 X 26	S	LDA to PDC	3 X 1	38°	N	IN STOCK	1 Year	
LD1599	830	823-837	200	9mm	300	10 X 30	S	LDC to PDA	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1362	830	820-840	150	9mm	185	7 X 7	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Internal Microlense
LD1278	830	820-840	150	9mm	185	7 X 18	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1446	830	820-840	40	9mm	120	10 X 10	S	LDC to PDA	3 X 1	60°	N	IN STOCK	1 Year	
LD1580	830	810-840	30	9mm	60	9 X 9	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1617	830	810-840	40	9mm	80	8 X 18	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1561	840	830-850	130	9mm	150	8 X 28	S	LDC to PDA	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1562	840	830-850	200	9mm	270	8 X 25	S	LDC to PDA	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1600	840	830-850	250	9mm	320	9 X 25	S	LDC to PDA	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1586	850	843-857	130	9mm	140	10 X 30	S	LDC to PDA	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1379	850	840-860	30	5.6mm	115	7 X 27	S	LDA to PDC	6 X 1	70°	Y	IN STOCK	1 Year	
LD1757	850	840-860	40	5.6mm	120	10 X 22	S	LDA to PDC	3 X 1	60°	N	IN STOCK	1 Year	
LD1469	850	845-855	5	5.6mm	20	10 X 30	S	LDA to PDC	3 X 1.5	40°	N	IN STOCK	1 Year	
LD1283	852	848-856	50	9mm	100	9 X 30	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1297	852	848-856	100	9mm	160	9 X 30	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1391	852	848-856	150	9mm	200	9 X 30	S	LDA to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1633	852	850-854	150	9mm	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1634	852	850-854	150	TO-3 w/ TEC	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1573	860	859-861	150	9mm	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1594	860	859-861	150	TO-3 w/ TEC	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1563	870	863-877	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1713	905	900-910	100	9mm	140	8 X 28	S	LDC to PDA	3 X 1	30°	N	IN STOCK	1 Year	
LD1648	905	895-915	10	5.6mm	40	13 X 33	S	LDA to PDC	3 X 1	70°	N	IN STOCK	1 Year	
LD1639	923	935-939	100	TO-3 w/ TEC	180	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1574	923	922-924	100	9mm	170	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1627	937	935-939	100	9mm	180	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1640	937	935-939	100	TO-3 w/ TEC	180	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1564	940	930-947	100	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1618	976	975-977	150	9mm	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1619	976	975-977	150	TO-3 w/ TEC	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	DFB LD
LD1394	980	975-985	300	9mm	300	8 X 30	S	LDA to PDC	3 X 1	50°	Y	IN STOCK	1 Year	
LD1711	980	975-985	50	9mm	70	8 X 30	S	LDC to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1371	980	975-985	50	9mm	70	8 X 30	S	LDA to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1647	980	970-990	1000	TO-3	1300	10 X 40	M	NO PD	100 X 1	50°	Y	INQUIRE	90 Days	
LD1347	980	975-985	300	9mm	330	6.5 X 30	S	LDA to PDC	3 X 1	50°	Y	RS	1 Year	
LD1370	980	975-985	50	9mm	115	8 X 30	S	LDA to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1372	980	975-985	250	9mm	260	8 X 30	S	LDA to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1709	980	975-985	250	9mm	260	9 X 9	S	LDA to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1720	980	970-983	50	9mm	95	8 X 33	S	LDA to PDC	3 X 1	60°	N	INQUIRE	1 Year	
LD1565	980	973-987	150	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1712	980	975-985	100	9mm	115	8 X 30	S	LDC to PDC	3 X 1	60°	Y	IN STOCK	1 Year	
LD1473	1060	1040-1070	10	5.6mm	45	10 X 30	S	LDA to PDC	3 X 1	40°	N	IN STOCK	1 Year	
LD1566	1060	1053-1068	100	9mm	130	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1641	1060	1059-1061	150	9mm	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1642	1060	1059-1061	150	TO-3 w/ TEC	230	8 X 21	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1575	1061		100	TO-3	170	10 X 33	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1576	1063		100	TO-3	170	10 X 33	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1567	1080		80	9mm	130	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1577	1083		80	TO-3	170	10 X 35	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1829	1110	1105-1120	50	9mm	150	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	
LD1568	1120	1110-1130	50	9mm	200	10 X 30	S	LDC to PDC	3 X 1	50°	Y	INQUIRE	1 Year	Ridge Waveguide
LD1623	1310	1290-1330	10	5.6mm	35	25 X 30	S	4 Leads	3 X 1	85°	Y	IN STOCK	1 Year	
LD1521	1310	1290-1330	10	5.6mm	35	25 X 30	S		3 X 1	85°	Y	IN STOCK	1 Year	
LD1783	1550	1520-1580	6	5.6mm	30	25 X 30	S	4 Leads	3 X 1	85°	Y	RS	1 Year	

CHAPTER

2

LASERS

BLUE, VIOLET & UV DIODE LASER MODULES



- Active temperature control
 - Beam circularization available
 - Modulated versions available
 - Stable wavelengths & output
 - Adjustable focus

Blue, violet, and ultraviolet laser modules at a glance

Compact, versatile, and highly cost-effective, our blue, violet, and ultraviolet IQ (Instrument Quality) laser diode modules are ideal replacements for bulky, inefficient gas lasers. Most applications that use Argon-Ion, Helium Cadmium, and blue Nd:YAG lasers can take advantage of this newer, more efficient technology. Such applications include laser-induced fluorescence, high-resolution printing, interferometry, confocal microscopy, holography, Raman spectroscopy, and bio-

analysis.

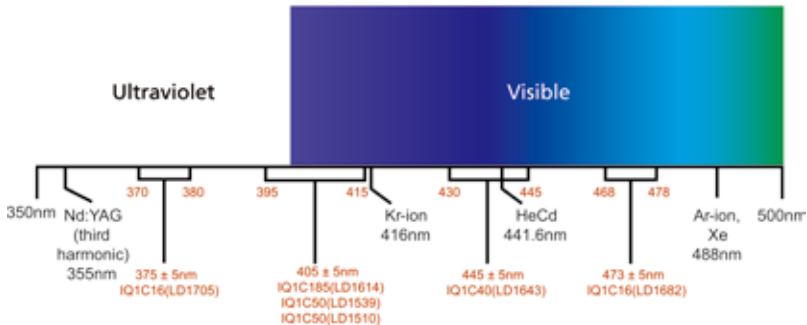
To meet the demands of your application, we now offer a 405 ± 10nm 185mW IQ, our highest power violet module to date. We also offer a cir- Blue, violet, and ultraviolet laser modules at a glance cularized 405 ± 5nm 50mW violet IQ, in addition to our standard elliptical beam version. Also available is our 16mW blue IQ unit at 473 ± 5nm and our 40mW blue IQ at 445 ± 5nm. In addition, we offer a 16mW ultraviolet IQ module at 375 ± 5nm.

Our blue, violet, and ultraviolet IQ laser diode modules are available with a circularized beam or with standard elliptical output. In addition, each unit features active temperature control and exceptional wavelength stability. Modulated versions are also available.

APPLICATIONS

- Holography
 - Cancer detection
 - Illumination
 - Data storage
 - Laser-induced fluorescence
 - Spectroscopy
 - High-resolution printing
 - Remote optical sensing
 - Flow cytometry

Recommended Models



Specifications	IQ1C16 (LD1682)	IQ1C40 (LD1643)	IQ1C430 (LD1741)	IQ1C320 (LD1763)	IQ1C185 (LD1614)	IQ1C50 (LD1539)	IQ1C50 (LD1510)	IQ1C16 (LD1705)
Wavelength (nm)	473 ± 5	445 ± 10	445 ± 10	405 ± 5	405 ± 10	405 ± 10	405 ± 10	375 ± 5
Output power (mW)	16	40	430	320	185	50	50	16
Dimensions, Ø x L, in	1.50 x 6.2 / 38.05 x 157.5**	1.50 x 6.2 / 38.05 x 157.5**	1.50 x 6.2 / 38.05 x 157.5**	1.50 x 6.2 / 38.05 x 157.5**	1.50 x 6.2 / 38.05 x 157.5	1.50 x 6.2 / 38.05 x 157.5	1.50 x 6.2 / 38.05 x 157.5**	1.50 x 6.2 / 38.05 x 157.5**
Beam shape	elliptical***	elliptical***	elliptical***	elliptical***	elliptical	elliptical	elliptical***	elliptical***
Collimated beam size at exit, 1/e2(mm)	2.5 x 40***	2.5 x 40***	2.5 x 40***	TBD	1.3 x 3.0	1.3	2.5 x 40***	2.5 x 40***
Beam divergence (mrad)	<0.5	<0.5	<1	<1	<1	<0.5	<0.5	<0.5
Operating voltage (VDC)	8 - 12	8 - 12	8 - 12	8 - 12	8 - 12	8 - 12	8 - 12	8 - 12
Max. Operating Current (mA)	3000	3000	3000	3000	3000	3000	3000	3000
Recommended Options****	G26	G26	G26	G26	G26	G26	G26	G26
Mounting Brackets	MB6	MB6	MB6	MB6	MB6	MB6	MB6	MB6

**Beam circularization available.
 ***IQ modules containing anamorphic prisms for beam correction are 7.5" [191.0mm] in length. See IQ2C drawing on the opposite side of this specification.

CHAPTER 2 LASERS

SELF-CONTAINED CW LASER MODULES



PM Laser Modules:

The PM is an industrial-grade laser module designed for use in standard or rugged OEM environments. The PM contains a precision current source that can deliver up to 120 mA of drive current to N-type or P-type laser diodes. For your more demanding applications, we recommend incorporating a heat sink into your unit. The module is ideal for a wide variety of applications, from positioning to alignment to bar code reading.

Self-contained modules include the diode, optics and power supply housed together in a single case. Each unit incorporates a basic aspheric lens to produce a quasi-collimated beam. Microlensing circularizes the naturally elliptical light output of a diode without the inclusion of correcting prisms and lenses.

RC Laser Modules:

The RC is designed to meet the needs of the price-sensitive OEM application. The RC offers a choice of wavelength and output power, all in an ultra-compact package. In fact, the RC is our smallest laser module. The unit operates in automatic power control mode.

RS Laser Modules:

Like the RC, the RS is a compact module designed for your cost-sensitive application. The output power of the RS is preset to fall within the range of your desired laser class, and units that are class 3a and below are CDRH certified, provided that users conned to the power source through a switch. The RS operates in automatic power control mode. An optional factory-installed line generating lens is available that is permanently attached to the module at a fixed focal distance. No adjustment of the lens is possible. For particularly demanding applications, we recommend incorporating a heat sink into your RS.



IQ1C&IQ2C Laser Modules:

For applications requiring the ultimate in PTI temperature stability, the 1Q1C and IQ2C feature a PID loop to control thermoelectric cooler output. These instrument-quality modules can deliver up to 1000mA of drive current to 9mm or 5.6mm laser diodes and can operate in either constant current or automatic power control mode. Each allows for DVM-compatible monitoring of temperature and drive current parameters. The IQ1C is available with an elliptical beam or a round beam achieved via a microlensed diode. The IQ2C incorporates anamorphic correcting prisms to produce a circularized beam.

PPM laser Modules:

The PPM module contains an active temperature control circuit, thermoelectric cooler, and fan to regulate the operating temperature of the diode. The PPM can operate in either constant current or automatic power control mode. Built-in potentiometers enable users to adjust the drive current, laser power, or active temperature control parameters, and a 7-pin connector allows for DVM-compatible monitoring of these parameters. The PPM is ideal for a variety of applications, including alignment and measurement. For those requiring active monitoring of their PPM, an optional side cover is available that allows users to plug directly into the unit.

MODULE SPECIFICATIONS	PM	RC	RS	PPM	IQ1C/IQ2C
Dimensions, $\phi \times L$, in.[mm]	.50x2.0 [12.57x50.80]	.46x1.30[11.68x33.02]	.43x1.46 [10.97x37.01]	1.5x5.70	1.5x6.20[38.05x157.48] / 1.5x7.52[38.05x191.01]
Operating Voltage(VDC)	3.3-9	3.3-9	3.3-9	12 $\pm$ 1	5-15
Max. Operating Current(mA)	120	100	65	1200	3000
Max. Laser Drive Current(mA)	120	100	60	500	1000
Temperature Stability($^{\circ}$ C)	-	-	-	.5	0.02
Temperature Range($^{\circ}$ C)	-	-	-	10-35	5-40
Control Signal Connector Type	9mm,5.6mm	9mm,5.6mm	9mm,5.6mm	9mm,5.6mm	9mm,5.6mm
Physical Diode Compatibility	N-type & P-type	N-type	N-type	N-type & P-type	M,N,P-type
Diode Compatibility	in APC, all in CC			in APC, all in CC	yes
Micro lens Compatible	yes	no	no	yes	G26
Recommended Options*	D1, T, S	L	L	D1, D2, D3, T	D4, D5, D6

* See page 1-24 through 1-26 for Options and Accessories

CHAPTER 2 LASERS

TTL MODULATED LASERS



Digital beam modulation requires a 0 or 5VDC, TTL-compatible input signal to control laser output. TTL modulation can be used to enable, inhibit, or modulate a laser, making it an excellent resource for synchronized applications.

Detector Option



See page 3-35

PMT and SPMT Laser Modules:

The PMT and SPMT are versatile choices suitable for a variety of OEM environments. Both operate in constant current mode and are designed for digital beam modulation from CW to 20MHz. The PMT is a self-contained module, while the SPMT features a separated geometry. The separated geometry configuration promotes easy positioning of the components within the design constraints of your application.

PPMT laser Modules:

Like the PMT the PPMT is designed for digital beam modulation from CW to 20MHz. However, the PPMT features active temperature control for added power and wavelength stability. The unit operates in constant current mode. Built-in potentiometers enable users to adjust the drive current or active temperature control parameters, and a 7-pin connector allows for DVM-compatible monitoring of these parameters.

PMH Laser Modules:

The PMH offers beam modulation from CW to 100MHz, perfect for demanding applications where power and speed are of most importance. The module features digital beam modulation with drive currents up to 120mA.

IQ1H & IQ2H Laser Modules:

For applications requiring beam modulation, power, speed and our highest level of temperature stability available, the IQ1H and IQ2H are ideal solutions. Each incorporates a PID loop to control TE cooler output and features beam modulation from CW to 100MHz. The IQ1H is available with an elliptical beam or a round beam achieved via a micro-lensed diode. The IQ2H incorporates anamorphic prisms to produce a circular beam.

TTL VS. Analog modulated Lasers

Several of our laser diode modules employ one of two types of modulation: analog or TTL. Analog modulation allows users to adjust a laser's output to a desired level from less than 5% to 100% of its maximum. ADC voltage of 0 to 1V generates this desired output, and this voltage can

be modulated at a relatively high rate, up to 20MHz in some cases. Analog modulators attempt to follow the shape of the 0 to 1V input signal with 0 to 100% laser output, limited only by how fast the modulator can respond and drive the laser.

TTL modulators emit 100% of their

power when a TTL "0" (0VDC) is input and less than 5% of their power when a TTL "1" (5VDC) is input. Unlike analog modulated laser. TTL modulated lasers cannot produce any level of fractional power. They are either ON or OFF. TTL modulators are designed primarily for applications requiring speed.

MODULE SPECIFICATIONS	PMT	SPMT	PPMT	PMH	IQ1H/IQ2H
Dimensions, φxL, in. [mm]	1.0 x 2.05 [25.4x52.1]	.5 x 1.24 [12.65x31.42]	1.5 x 5.7 [38.05x144.78]	1.0 x 2.65 [25.4x67.31]	1.5 x 6.20 [38.05x157.48] /1.5 x 7.52 [38.05x191.01]
Operating Voltage(VDC)	5 ± 0.5	5 ± 0.5	12 ± 1	5 ± 0.5	5 - 14
Max. Operating Current(mA)	280	280	1500	350	3000
Max. Laser Drive Current(mA)	0 - 200	0 - 200	0 - 200	120 bias + 200 mod	1000 bias + 120 mod
Mod. Frequency Range (MHz)	CW - 20	CW - 20	CW - 20	CW - 100*	CW - 100*
Rise/Fall Times (ns)	6/15*	6/15*	6/15*	2*	2*
Propagation Delay (ns)	30*	30*	30*	5*	6*
Temperature Stability(°C)	-	-	5	-	02
Temperature Range(°C)	-	-	10 - 35	-	0 - 40
Control Signal Connector Type	SMC	BNC	BNC	SMC	SMC
Physical Diode Compatibility	9mm, 5.6mm	9mm, 5.6mm	9mm, 5.6mm	9mm, 5.6mm	9mm, 5.6mm
Diode Compatibility	all	all	all	all	all
Recommended Options**	D2, T, X22	D2, T, X25, X26	D2, D3, T	D5, X21, X22, X23	D4, D5, D6

* See page 1-24 through 1-26 for Options and Accessories

CHAPTER 2 LASERS

ANALOG MODULATED LASERS



Analog modulated laser are capable of modulation from CW up to 20MHz. Analog modulation allows users to adjust laser's output to a desired level from <5% to 100% of its maximum, providing added control.

IR Card Option



See page 3-55

- PMA is the perfect solution for such applications as testing & fluorescence
- IQ1A&IQ2A are ideal for applications requiring beam modulation & ultra-stable temperature

PMA Laser Modules:

The PMA supports analog beam modulation from CW to 20MHz with bias currents from 0 to 200mA and modulation currents from 0 to 200mA. Please note that the unit's combined bias current and modulation current cannot exceed 300mA. The PMA allows for DVM-compatible monitoring of the module's drive current and output power. The unit serves as the perfect solution to any number of applications, including laser-induced fluorescence, testing, and biomedical procedures.

IQ1A & IQ2A Laser Modules:

For applications requiring beam modulation and an ultra-stable temperature, the IQ1A and IQ2A are ideal choices. These instrument quality modules incorporate a PID temperature controller and precision current source and feature analog beam modulation from CW to 20MHz. Each allows for DVM-compatible monitoring of temperature and drive current parameters. The IQ1A is available with an elliptical beam or a round beam achieved via a microlensed diode. The IQ2A incorporates anamorphic correcting prisms to produce a circular beam.

MODULE SPECIFICATIONS	PMA	IQ1A/IQ2A
Dimensions, $\phi \times L$, in./mm	1.0x2.65[25.40x67.31]	1.5x6.20[38.05x153.6] / 1.5x7.52[38.05x191.01]
Operating Voltage(VDC)	5 $\pm$ 0.5	5-14
Max. Operating Current(mA)	370	3000
Modulation Current Above Bias(mA)	120 bias+200 mod.	1000 bias + 200 mod
Mod. Frequency Range(MHz)	CW-50	CW-20
Rise/Fall time(ns)	10/14	6
Propagation Delay(ns)	22	18
Temperature Stability($^{\circ}$ C)	-	0.02
Temperature Range($^{\circ}$ C)	-	0-40
Control Signal Connector Type	SMC	SMC
Physical Diode Compatibility	9mm,5.6mm	9mm,5.6mm
Diode Compatibility	all	all

CHAPTER 2

LASERS

BEAM-CORRECTED LASER MODULES

CW LASER MODULEs WITH BEAM CORRECTION



ACM Laser Modules:

The ACM is an excellent replacement for large, inefficient gas laser. The unit yields a round beam that imitates a gas laser’s naturally circular beam while offering several advantages: compact size, lighter weight, and dramatically lower power consumption. The ACM achieves its beam circularization via a pair of anamorphic correcting prisms, an astigmatic lens, and an output aperture. The unit operates in automatic power control mode and serves as an ideal OEM component for positioning, alignment and measurement applications.

APM Laser Modules:

The APM module not only offers a circularized beam, but it includes an active temperature control circuit, TE cooler and fan to control the diode’s operating temperature. These temperature control mechanisms-in addition to promoting stability of wavelength and output power-help to extend the life of the diode. The APM operates in constant current mode or automatic power control mode. Built-in potentiometers enable users to adjust or change the drive current, laser power or active temperature control parameters, and a 7- pin connector allows for DVM-compatible monitoring of these parameters.



- ACMT incorporates both digital beam modulation & beam circularizing optics
- APMT features a round beam, beam modulation & temperature control

TTL MODULATED LASERS WITH BEAM CORRECTION

ACMT Laser Modules:

The ACMT incorporates digital beam modulation and anamorphic correcting prisms, yielding a high quality, circularized beam. The unit is designed for digital beam modulation from CW to 20MHz and operates in constant current mode at a factory preset, customer-specified output power. Optional potentiometers are available for amplitude control.

APMT Laser Modules:

In addition to beam modulation and circularizing optics, the APMT provides active temperature control to maintain a stable operating temperature for the laser diode. The APMT operates in constant current mode and is designed for external TTL modulation from CW to 20MHz. Built-in potentiometers enable users to adjust or change the drive current amplitude, output power, or active temperature control parameters, and a 7-pin connector allows for DVM-compatible monitoring of these parameters.

MODULE SPECIFICATIONS	ACM	APM	ACMT	APMT
Dimensions,φxL, in./mm	1.00x2.25 [25.37x57.15]	1.50x6.97 [38.05x177.04]	1.00x2.25 [25.37x57.15]	1.50x6.97 [38.05x177.04]
Operating Voltage(VDC)	3.3-9	12 ± 1	5 ± 0.5	12 ± 1
Max. Operating Current	120	1350	240	1350
Max. Laser Drive Current(mA)	120	500	200	200
Temperature Stability(°C)	5	.5	-	.5
Temperature Range(°C)	10-35	10-35	-	10-35
Physical Diode Compatibility	9mm,5.6mm	9mm,5.6mm	9mm,5.6mm	9mm,5.6mm
Diode Compatibility	N type & P type in APC, all in CC	M type & N type in APC, all in CC	all	all
Beam Size At Exit,1/e ² (mm)	2.7	2.7	2.7	2.7
Recommended Options*	D1,T,X12	D1,D2,D3,T	D2,T,X22,X25,X26	D2,D3,T

* See page 1-24 through 1-26 for Options and Accessories

CHAPTER 2 LASERS

HIGH POWER CW LASER MODULES

HIGH POWER CW LASER MODULES



- HAM contains an internal fan & heat sink for thermal management
- HPM&HSM offer temperature
- control circuitry in addition to an internal fan & heat sink

HAM Laser Modules:

The HAM is designed for use with high power laser diodes with current requirements over 500mA. The HAM operates in either constant current or automatic power control mode, depending on the type of diode selected. For effective thermal management, the unit also contains an internal fan and heat sink.

HPM & HSM Laser Modules:

In addition to the internal fan and heat sink used by the HAM, our HPM and HSM modules incorporate an active temperature control circuit for those laser diodes with a built-in thermoelectric cooler. The HPM offers 1000mA of drive current, while the HSM features 2000mA. Both units operate in either constant current or automatic power control mode, depending on the type of diode selected.



See page 3-65

MODULE SPECIFICATIONS	HAM	HPM	HSM
Dimensions, $\phi \times L$, in./mm	1.75x7.87 [44.45x199.90]	1.75x7.87 [44.45x199.90]	1.75x9.79 [44.45x248.67]
Operating Voltage (VDC)	12 $\pm$.25	12 $\pm$.25	12 $\pm$.25
Max. Operating Current (mA)	2400	3200	4200
Max. Laser Drive Current (mA)	2000	1000	2000
Physical Diode Compatibility	9mm, TO-3, C Block	TO-3 with TEC	TO-3 with TEC
Diode Compatibility	M type, N type, & 4-pin in APC, all in CC	M type, N type, & 4-pin in APC, all in CC	M type, N type, & 4-pin in APC, all in CC
Recommended Options*	D1, D2, X12, X16, X22, X26	D1, D2	X12, X16, X22, X26

* See page 1-24 through 1-26 for Options and Accessories

CHAPTER

2

LASERS

ULTRA-STABLE TEMPERATURE

LASER MODULES & LASER HEAD

Laser Modules & Laser head

IQ Module Features

- CW, analog modulation or digital beam modulation
- PID tem perature controller
- Precision current source
- Circular or elliptical beam
- Quality glass optics
- Wavelengths from 370 to 1600nm

Our IQ laser heads and modules are “instrument quality” OEM products with superior thermal and optical specifications. They are excellent choices for any number of analyti- cal applications requiring stability of wavelength and output power.



IQ Series laser Modules

For high-end OEM applications requir- ing superior optical quality and ultra- stable temperatures, wavelengths and output powers, our IQ series laser mod- ules are the perfect solution. IQ mod- ules feature a precision current source and a PID temperature controller. They incorporate quality glass lenses and can host laser diodes with wavelengths from 370 to 1600nm. IQ modules can operate in either constant current or au-

tomatic power control mode. Our IQ series lasers are available with CW, analog modulated, or TTL modu- lated output. The IQ1C model operates in CW mode and can deliver up to 1000 mA of drive current. The IQ1H version is capable of 100 MHz digital beam modulation, while the 1Q1A can deliver 20 MHz of analog beam modulation. Each is available with a standard ellipti- cal beam or a circular beam achieved

via a microlensed diode. Also available are the IQ2C, IQ2H and IQ2A alternate model that feature anamorphic correct- ing prisms to produce a circularized beam. IQ modules are excellent choices for a variety of analytical applications, including fluorescence, spectroscopy, interferometry, high-resolution printing, display and microscopy.

IQ laser head

IQ Head Features

- Precision centering
- Integrated TE cooler
- Superior heat dissipation
- Quality glass optics
- Small beam size
- Excellent pointing stability

The IQ laser head provides exceptional beam pointing stability and maximum heat transfer from the laser diode to the IQ’s base.

Thermal stability:

The IQ laser head features a custom-made thermoelectric cooler. Unlike other lasers that pull heat from one side of the laser diode, the heat in the IQ is removed from the diode’s largest heat-bearing surface: the bottom.

Optical quality:

We use high-quality glass lenses to achieve optical superiority. For added beam quality, users may choose to incorporate a laser diode with integrated Blue sky μLENSTM to provide a circular, diffraction-limited beam with low divergence. The IQ head is well-suited for a variety of OEM applications, including instrumentation and spectroscopy. Also available is a complete IQ laser system that includes a power supply, precision temperature controller, and IQ head with integrated thermo- electric cooler.

SPECIFICATIONS	IQ1A/IQ2A	IQ1C/IQ2C	IQ1H/IQ2H	IQ HEAD
Dimensions, φ x L, in. [mm]	1.50 x 6.05 [38.05 x 153.6] / 1.50 x 7.52 [38.05 x 191.01]	1.50 x 6.05 [38.05 x 153.6] / 1.50 x 7.52 [38.05 x 191.01]	1.50 x 6.05 [38.05 x 153.6] / 1.50 x 7.52 [38.05 x 191.01]	0.75 x 1.51 [19.05 x 38.35]
Operating Voltage (VDC)	5-15	5-15	5-15	diode dependent
Max. Operating Current (mA)	3000	3000	3000	-
Max. Laser Drive Current (mA)	-	1000	-	-
Mod. Frequency Range(MHz)	CW-70	-	CW-100	-
Mod. Current Above Bias (mA)	10-1000	-	450	diode dependent
Temperature Stability (°C)	0.02	0.02	0.02	controller dependent
Temperature Range (°C)	5-40	5-40	5-40	controller dependent
Rise/Full (ns)	10	-	2	-
Propagation Delay (ns)	20	-	10	-
Physical Diode Compatibility	9mm, 5.6mm	9mm, 5.6mm	9mm, 5.6mm	9mm, 5.6mm
Mounting Brackets	MB6	MB6	MB6	

CHAPTER 2 LASERS

PULSED DIOE LASER MODULES



Featuring peak output powers of up to 100W, these pulsed Laser Diode Modules offer pulse widths ranging from 7 to 50ns with fast rise and fall time.

ML Series:

The ML family of pulsed laser modules offers peak output powers of up to 100W at 905nm. These units include the laser diode, focusing lens, and pulse drive electronics and require only a regulated DC input voltage and a TTL timing trigger to operate. ML series pulsers are ideal for applications requiring high peak pulse powers, such as rangefinding and lidar.

ILC & IPC Series

Our ILC and IPC pulsers offer peak pulse currents from 1 to 105A and pulse widths from 7 to 500ns. Available wavelengths include 850, 905, 1064, and 1550nm. ILC family contain an internal power supply that allows for either a built-in trigger pulse or a user-supplied trigger. IPC pulsers do not incorporate an internal power supply, so users must supply a trigger pulse and a bias voltage. Both series are temperature compensated to regulate output power, and both are suitable for any number of applications, including rangefinding, atmospheric communications, lidar and biomedical analysis.

MODULE SPECIFICATIONS	ML20A15	ML40H15	ML60H15	ML100H15
Dimensions, W x L x H, in. / mm	2.12 x 3.40 x 0.58 / 53.85 x 86.44 x 14.73	2.12 x 3.40 x 1.02 / 53.85 x 86.44 x 26.01	2.12 x 3.40 x 1.02 / 53.85 x 86.44 x 26.01	2.12 x 3.40 x 1.02 / 53.85 x 86.44 x 26.01
Peak Output Power (W)	20	40	60	100
Pulse Width (ns)	15	15	15	15
Max. Pulse Repetition Frequency (kHz)	10	10	6	5
Operating Voltage (VDC)	9-14.5	9-14.5	9-14.5	9-14.5
Max. Operating Current (mA)	100	150	120	150
Max. Laser Drive Current (mA)	17000	17000	20000	21000

PULSER SPECIFICATIONS	IL9C	IL10C	IL20C	IL25C	IL30C	IL40C	IL60C	IL75C
Dimensions, ϕ x L, in. / mm	1.0 x 4.0 / 25.4 x 101.6	1.0 x 4.0 / 25.4 x 101.6	1.0 x 4.0 / 25.4 x 101.6	1.0 x 4.0 / 25.4 x 101.6	1.0 x 4.0 / 25.4 x 101.6	1.25 x 4.0 / 31.75 x 101.6	1.25 x 4.0 / 31.75 x 101.6	1.25 x 4.0 / 31.75 x 101.6
Pulse Current (adjustable, A)	1-9	6-11	11-22	14-27.5	16-33	22-44	33-66	41-82.5
7-50ns Pulse Width	Rise Time (ns, typical)	2	2	3	4	4	5	8
	Fall Time (ns, typical)	2	3	5	6	6	7	10
51-200ns Pulse Width	Rise Time (ns, typical)	12	14	16	18	28	20	24
	Fall Time (ns, typical)	14	16	18	20	20	22	28
Max. Pulse Rate (kpps)	External Trigger	50	40	30	20	20	20	15
	Internal Clock	20	20	20	20	20	20	20
Propagation Delay (ns)	10	10	10	10	10	10	10	10
Supply Voltage (VDC)	12-24	12-24	12-24	12-24	12-24	12-24	12-24	12-24
Physical Diode Compatibility	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32	9 & 5.6mm 8:32, 10:32

CHAPTER

2

LASERS

OPTIONS & ACCESSORIES

D Option: Digital Control

Modules compatible with our digital control options can interface directly with computerized or electronic control circuits. This interface promotes precise control of a laser’s output power, wavelength, and temperature. Our TTL-compatible D options have a memory that will retain a module’s setting for future use after deactivation. They can be used as a one-time calibration of a laser’s settings or as a means of dynamically altering these settings as new needs arise.

Options D1, D2, and D3 are economical, lower resolution choices that provide up to 100 possible adjustment positions. Options D4, D5, and D6 offer more precision and higher resolution and are capable of either 256 or 512 adjustment positions.

OPTION	DESCRIPTION	RESOLUTION
D1	Digital Automatic Power Control	100 positions
D2	Digital Automatic Power Control	100 positions
D3	Digital Temperature Control	100 positions
D4	High Resolution Digital Automatic Power Control	256 positions
D4b	High Resolution Digital Automatic Power Control	512 positions
D5	High Resolution Digital Constant Current Control	256 positions
D5b	High Resolution Digital Constant Current Control	512 positions
D6	High Resolution Digital Temperature Control	256 positions
D6b	High Resolution Digital Temperature Control	512 positions

F Option: Fiber Coupling



Fiber coupling is a method used to couple a laser’s output into a fiber optic. we couple fibers directly to the laser module, not the diode. Depending on the laser assembly ordered, the module will contain a length of single-mode or multi-mode fiber, along with the appropriate connectors.

A single-mode fiber allows light to travel a long a single path through the middle of the fiber core. This type of fiber is typically used for applications requiring ultra-high quality light output and is available as an option for many of our temperature controlled laser modules.

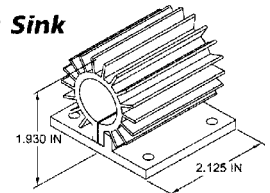
A multi-mode fiber enable light waves to travel simultaneously along multiple paths within the core. Because the core of a multi-mode fiber is larger than that of a single-mode, multi-mode fibers tend to be useful for less wavelength-sensitive applications.

OPTION	DESCRIPTION	FIBER POLISH
F1	Multi-mode fiber with SMA 905 connector	Physical contact
F2	Single-mode fiber with FC connector	Physical contact
F7	Multi-mode fiber with FC connector	Physical contact

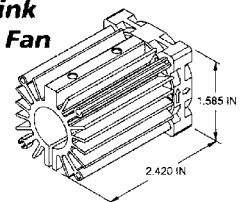
H: Option: Heat Sink

A heat sink is used to cool the laser diode when the ambient temperature is too high. When the diode generates too much internal heat, the heat sink dissipates the heat away from it. We offer two versions of our heat sink: a standard model and one that enables users to incorporate a fan into their unit. Both models are suitable for any module with a diameter less than 0.75 inch(19mm).

Heat Sink



Heat Sink With Fan



L Option: line Generation



We use two types of optics to generate lines: even intensity and cylindrical.

Even Intensity optics: An even intensity line generator produces a superior, uniform line that is as bright on the ends as it is in the center. Even intensity optics are suitable for applications ranging from machine vision to road inspection to 3D mapping.

Cylindrical Optics: Cylindrical optics are the most cost-effective means of generating lines. They transform a simple laser dot into a single bright line with power concentrated in the center. This traditional form of optics is ideal for any number of applications, including research and microlithography.

Even Intensity Optics:

LENS PART#	APPROX. LINE LENGTH@ 12"	FULL FAN ANGLE
L70	53mm	10°
L71	107mm	20°
L72	163mm	30°
L73	252mm	45°
L74	352mm	60°
L75	610mm	90°

Cylindrical Optics

LENS PART#	APPROX. LINE LENGTH@ 12"	FULL FAN ANGLE
L0	15mm	2.8°
L9	21mm	4.0°
L8	29mm	5.5°
L7	40mm	7.6°
L6	80mm	15°
L3	96mm	18°

LENS PART#	APPROX. LINE LENGTH@ 12"	FULL FAN ANGLE
L13	102mm	19°
L5	124mm	23°
L4	152mm	28°
L2	198mm	36°
L1	352mm	60°
L10	610mm	90°



T Option: Telescope collimators

Telescope collimators are used to reduce, enlarge, or collimate output beams. They may also be used to focus beams on small areas at long distances. We offer a wide selection of compact telescope accessories that attach to the front end of a laser module. Telescopes are available as options for the following modules: PM, APM, ACM, PPM, SPM, and all modulated versions of these lasers.

SIMPLE BEAM REDUCERS

T19	0.17X
T13	0.25X
T16	0.33X
T25	0.40X
T6	0.50X

BEAM EXPANDERS (18mm OUTPUT APERTURE)

T7	4x beam expanding with threaded end for additional optics
T11	4x beam expanding/collimating telescope
T9	6x beam expanding/collimating telescope
T20	6x beam expanding with threaded end for additional optics
T17	7.5x beam expanding/collimating telescope

X Option: Adjustment Potentiometer

The X option represent a wide range of electronic control adjustments that you can make to a laser.

AUTOMATIC POWER CONTROL MODE

X11	Internal fixed
X12	Internal 3/4 turn pot
X13	Internal 12 turn pot
X14	External fixed
X15	External 3/4 turn pot
X16	External 12 turn pot

CONSTANT CURRENT MODE

X21	Internal fixed
X22	Internal 3/4 turn pot
X23	Internal 12 turn pot
X24	External fixed
X25	External 3/4 turn pot
X26	External 12 turn pot

TEMPERATURE CONTROL

X41	Internal fixed
X42	Internal 3/4 turn pot
X43	Internal 12 turn pot
X44	External fixed
X45	External 3/4 turn pot
X46	External 12 turn pot

CHAPTER 2 LASERS

LASER DIODES

Laser Diode selection guide



405 nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
DL3146-151	405	5	Ø5.6	5B	No	Single Mode

63x nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
HL6314MG	635	3	Ø5.6	5A	No	Single Mode
HL6312G	635	5	Ø9	9A	No	Single Mode
DL3148-025	635	5	Ø5.6	5A	No	Single Mode
HL6335G	635	5	Ø9	9A	No	Single Mode
HL6344G	635	10	Ø9	9A	No	Single Mode
HL6320G	635	10	Ø9	9A	No	Single Mode
HL6322G	635	15	Ø9	9A	No	Single Mode
DL5038-021	635	35	Ø9	9A	No	Single Mode
DL5148-030	635	20	Ø5.6	5A	No	Single Mode
DL6148-030	635	40	Ø5.6	5A	No	Single Mode

65x nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
DL3147-060	650	7	Ø5.6	5A	No	Single Mode
HL6501MG	658	30	Ø5.6	5C	No	Single Mode
DL6147-040	658	40	Ø5.6	5A	No	Single Mode
HL6512MG	658	50	Ø5.6	-	No	Single Mode
DL7147-201	658	60	Ø5.6	-	No	Single Mode

660 nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
HL6548FG	660	90	Ø9	9F	No	Single Mode
HL6545MG	660	130	Ø5.6	-	No	Single Mode
ML101J27	660	130	Ø5.6	-	Yes	Single Mode

670 nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
HL6724MG	670	5	Ø5.6	5A	No	Single Mode
DL3149-057	670	7	Ø5.6	5C	No	Single Mode
HL6714G	670	10	Ø9	9A	No	Single Mode

690 nm Wavelength

Item #	Wavelength (nm)	Power (mW)	Package (mm)	Pin Code	Wavelength Tested	Mode
HL6738MG	690	30	Ø5.6	5C	No	Single Mode

BENCHTOP LASER DIODE/TEC CONTROLLER OVERVIEW

- Highly Reliable Protection of Laser Diodes
- Extremely Low Noise
- Compatible with all Laser Diode & Photodiode Polarities

Features

- Extremely Low Noise (LDC201CU 0.2 μ A)
- 5-Digit LED Display
- Analog Control Input and Output
- Reliable Laser Diode Protection
- Operates With All Polarities of Laser Diode and Photodiode
- Seven Models With Laser Current Ranges From 20 mA to 4 A



The laser diode controllers in the LDC200C series all provide features that ensure outstanding performance. There are seven models with different current ranges, each configured to provide optimal performance for their particular application. Please refer to the Specs tab and the Selection Guide tab for an overview of the products.

Modes

With the laser diode controllers of the LDC200C series, laser diodes can be driven in constant current (CC) or constant power (CP) mode. All laser diode and photodiode configuration types are supported. The laser diode is always driven with respect to ground. In comparison to driver designs that require a floating ground, this grounded operation of the laser diode offers advantages regarding noise, transient suppression, and stability.

Constant Current

In CC mode, the current to the laser is held precisely at the prescribed level. This mode is used when the lowest noise and highest response speed is required. Most applications in this mode require stabilizing the temperature as well. We offer two lines of temperature controllers, the TED200C for up to 12 W and the TED4015 for up to 225 W.

Constant Power

In CP mode, the internal photodiode integrated into most laser diode packages is used to actively stabilize the laser's output power, which is adjusted by a feedback circuit. An adjustment of the full scale photodiode current in CP mode is provided in order to compensate for the differences in the photodiode currents between different laser diodes.

Controller Use

Intuitive User-Friendly Operation

Independent of the selected operating mode, the 5-digit LED display can show the laser current, the photodiode monitor current, or laser current limit. It can also display the optical power (in mW). The power readout can be calibrated to the responsivity of the monitor photodiode by adjusting a front panel trim potentiometer.

Benefits

In many applications, the aforementioned benefits eliminate the need for a separate optical power meter. Available for use at the rear of the unit are: a modulation input for laser current or power, a control output proportional to the laser current, and a TTL input for remote laser on/off.

Protection Features

Current Limit

A precisely adjustable current limit ensures that the maximum laser current cannot be exceeded. Thorlabs has intentionally provided limited access to this feature to prevent accidental adjustment. An attempt to increase the laser drive current above the pre-set limit will result in a visible and short audible indicator. Even when utilizing the external modulation feature, the current limit set-point cannot be exceeded.

Current Source

If the connection between the current source and laser diode is interrupted, the current source automatically switches off the current output. The open current circuit condition is indicated by the LED "OPEN" and a short acoustic warning. The separate laser ON key switches the laser current on and off. When switched off, an electronic switch within the LDC200C short circuits the laser diode for added protection. After being switched on, a soft start ensures a slow increase of the laser current without voltage peaks. Even in the case of line failure, the laser current remains transient-free. Voltage peaks on the AC line are effectively suppressed by electrical filters, shielding of the transformer, and careful grounding of the chassis.



Model	LDC200CV	LDC201CU	LDC202C	LDC205C	LDC210C	LDC220C	LDC240C
Current Control (Constant Current Mode)							
Control Range	0 to ±20 mA	0 to ±100 mA	0 to ±200 mA	0 to ±500 mA	0 to ±1 A	0 to ±2 A	0 to ±4 A
Compliance Voltage	>6 V	>5 V	>10 V	>10 V	>10 V	>4 V	>5 V
Resolution	1.0 μA	10 μA	10 μA	10 μA	100 μA	100 μA	100 μA
Accuracy	±20 μA	±50 μA	±100 μA	±0.5 mA	±1.0 mA	±2.0 mA	±4.0 mA
Noise Without Ripple*	<1.0 μA	<0.2 μA	<1.5 μA	< 3 μA	<5 μA	<15 μA	<50 μA
Ripple**	<0.5 μA	<0.5 μA	<1.5 μA	< 2 μA	<3 μA	<5 μA	<8 μA
Transients (typ.)	<10 μA	<10 μA	<0.2 mA	< 0.5 mA	<1 mA	<2 mA	<4 mA
Drift, 24hours ***	<1 μA	<2 μA	<3 μA	<10 μA	<20 μA	<100 μA	<200 μA
Temperature Coefficient	<50 ppm/°C						
Current Limit							
Setting Range	0 to >20 mA	0 to >100 mA	0 to >200 mA	0 to >500 mA	0 to >1 A	0 to >2 A	0 to >4 A
Resolution	1 μA	10 μA	10 μA	10 μA	100 μA	100 μA	100 μA
Accuracy	± 50 μA	± 200 μA	± 500 μA	±1.5 mA	± 2.5 mA	± 5 mA	± 10 mA
Power Control (Constant Power Mode)							
Photocurrent Control Range	5 μA to 2 mA	25 μA to 10 mA			50 μA to 20 mA		
Photocurrent Resolution	0.1 μA	1 μA			1 μA		
Photocurrent Accuracy	±2 μA	±10 μA			±20 μA		
Analog Modulation Input							
Input Resistance				10 kΩ			
Small Signal 3dB Bandwidth, CC Mode	DC to 100 kHz	DC to 0.2 kHz	DC to 250 kHz	DC to 150 kHz	DC to 100 kHz	DC to 50 kHz	DC to 30 kHz
Modulation Coefficient, CC Mode	2 mA/V ±5%	10 mA/V ±5%	20 mA/V ±5%	50 mA/V ±5%	100 mA/V ±5%	200 mA/V ±5%	400 mA/V ±5%
Modulation Coefficient, CP Mode	0.2 mA/V ±5%	1 mA/V ±5%			2 mA/V ±5%		
Laser Current Monitor Output							
Load Resistance				>10 kΩ			
Transmission Coefficient	500 V/A ±5%	100 V/A ±5%	50 V/A ±5%	20 V/A ±5%	10 V/A ±5%	5 V/A ±5%	2.5 V/A ±5%
General data							
Safety Features		Interlock, Laser Current Limit, Soft Start, Short Circuit when Laser off, Open Circuit Detection, Over Temperature Protection					
Display		LED, 5 Digits					
Connector for Laser, Photodiode,Interlock & Laser On Signal		9-pin D-Sub Jack					
Connectors for Control Input / Output		BNC					
Chassis Ground Connector		4mm Banana Jack					
Line Voltage / Frequency		100 V, 115 V, 230 V +15% –10% each / 50 to 60 Hz					
Mode	LDC200CV	LDC201U	LDC202C	LDC205C	LDC210C	LDC220C	LDC240C
Maximum Power Consumption	20 VA	20 VA	25 VA	30 VA	40 VA	60 VA	100 VA
Operating Temperature		0 to +40°C					
Storage Temperature		- 40 to +70°C					
Warm-up Time for Rated Accuracy		10 min					
Weight		<3.1 kg			<3.3 kg		
Dimensions (W X H X D) without Operating Elements		146 x 66 x 290 mm³					
Dimensions (W X H X D) with Operating Elements		146 x 77 x 320 mm³					

CHAPTER 2 LASERS

LTC100 LASER / TEMPERATURE CONTROL SYSTEM

Complete Laser and Temperature Control System Includes
 LDC205C Laser Diode Controller(page 1-34)
 TED200C Temperature Controller(page 1- 39)
 TCLDM9 Cooled Laser Diode Mount(page1- 42)
 Accessory Kit Included
 AR Coated Aspheric Lens Included



Our popular LDC205C Laser Diode Controller, TED200C Temperature Controller, and TCLDM9 TEC Cooled Laser Diode Mount are now available in a bundled package, complete with all the necessary cables to connect both controllers to the mount, plus all of the accessories shown below! When purchased together you will save 10% over the cost of buying each product separately!

These three products form the basis of a versatile and easy to use laser diode operating system. The 500mA LDC205 has been a favorite laser controller of ours for years, offering precise control of a laser diode's power in either a constant current mode, or constant power mode. The 12W TED200C has been our mainstay temperature controller, providing current and stability to the two TEC elements incorporated into our TCLDM9 mount.

Item	DESCRIPTION
LTC100-B	Laser/Temperature Control System with 600-1050nm AR coating Aspheric Lens
LTC100-C	Laser/Temperature Control System with 1050-1550nm AR coating Aspheric Lens



CHAPTER 2 LASERS

HIGH POWER LASER DIODE CONTROLLERS



The LDC4000 Series of Laser Diode Current Controllers provide precise and stable current for driving high-power laser diodes with injection currents up to 20 A. This series supports all laser diode and monitor diode pin configurations and features a constant current or constant power mode. The series is designed for stand-alone operation and is controlled via front panel keys and intuitive operation menus on a large and easy-to-read graphic LC display. See the Display Screens tab for some examples. Additionally, the LDC4000 Series can be fully remote controlled via an SCPI compatible USB Interface. A higher setting resolution and measurement resolution is offered via remote control.

The LDC200C Series, the LDC4000 Series offers higher injection currents as well as additional features like the Quasi-Continuous Wave (QCW) operation mode, an internal modulation generator, a thermopile input, laser voltage measurement, and an optical power limit. These features, together with the new design, which offers silent and efficient operation, make the LDC4000

Series Laser Diode Controllers an ideal choice for most applications. For more information about the constant current and constant power modes, the photodiode and thermopile monitor inputs, the continuous wave (CW) or quasi-continuous wave (QCW) operation and the enhanced protection features for the laser diodes please see the More Info tab.

Laser Diode Controller Features

- Two Models for 5 A and 20 A Laser Currents
- Operate with Anode- or Cathode-Grounded Laser Diodes and Photodiodes
- Also Capable of Driving LEDs in CW
- Continuous Wave or Quasi-Continuous Wave Operation
- Internal Function Generator for Analog Modulation
- External Modulation Input
- Analog Monitor Output for the Laser Current # Laser Diode Voltage Measurement
- Power Efficient by Active Power Management
- Compatible Optical Detectors:
 - Photodiodes
 - Thermopiles
 - Sensors with Amplifier
 - Power Meters
- Control Modes:
 - Constant Current (CC)
 - Constant Power (CP)
- Enhanced Laser Diode Protection Features:
 - Adjustable Laser Current Limit
 - Adjustable Laser Power Limit
 - Laser Over-Voltage Protection
 - Over Temperature Protection
- Interface and Drivers:
 - USB Interface (SCPI compliant)
 - VXIpinp/VISA Drivers for all Common Programming Environments like LabWindows/CVI™, LabVIEW™, and MS Visual Studio™

Item #	LDC4005	LDC4020
Laser Current Control Range	0 to 5 A	0 to 20 A
Compliance Voltage	>10V	
Photocurrent Measurement Ranges	2 mA / 20 mA	
Power Monitor	10 mV / 100 mV / 1 V / 10 V	
Voltage Measurement Ranges		
QCW* Pulse Width Range	100 μ s to 1 s	
QCW* Repetition Rate Range	1 ms to 5 s (0.2 to 1000 Hz)	
Internal Modulation Waveforms	Sine, Square, Triangle	
Internal Modulation	20 Hz to	20 Hz to
Small Signal Bandwidth	100 kHz	50 kHz

12W LASER DIODE TEMPERATURE CONTROLLERS



- Compatible Sensors: Thermistors, AD590/AD592, LM335
- TEC Output (Low Noise): ± 2 A / 12 W
- Temperature Range from -45°C to $+145^{\circ}\text{C}$ (AD590) or $10\ \Omega$ to $200\ \text{k}\Omega$ (Thermistor)
- Temperature Resolution: 0.01°C (IC-Sensor) or $1\ \Omega$ (Thermistor)
- Temperature Stability: $\leq 0.002^{\circ}\text{C}$
- Separate Adjustment of the P, I and D Share of the Control Loop for Shortest Temperature Settling Time
- Constant Temperature Operating Mode
- Analog Control via the TUNE IN Input
- Adjustable TEC Current Limit
- Detection of Incorrect or Missing Temperature Sensor and Open TEC Connection
- RoHS Compliant

Model	TED200C
TEC Current Output	
Control Range	-2 A to $+2$ A
Compliance Voltage	>6 V
Maximum Output Power	12 W
Measurement Resolution	1 mA
Accuracy	± 10 mA
Noise and Ripple (typ.)	<1 mA
TEC Current Limit	
Setting Range	0 to >2 A
Measurement Resolution	1 mA
Accuracy	± 20 mA
Thermistor Sensors*	
Control Range	$10\ \Omega$ to $20\ \text{k}\Omega$ / $100\ \Omega$ to $200\ \text{k}\Omega$ (2 Ranges)
Setting Resolution	$1\ \Omega$ / $10\ \Omega$
($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range)	
Measurement Resolution	$1\ \Omega$ / $10\ \Omega$
($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range)	
Accuracy ($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range):	$\pm 10\ \Omega$ / $\pm 100\ \Omega$
Temperature Stability 24 hours **	$<0.5\ \Omega$ / $<5\ \Omega$
($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range)	
IC Sensors	
Supported Sensors	AD590, AD592, LM135, LM335
Control Range with AD590, LM135	-45°C to $+145^{\circ}\text{C}$
Control Range with AD592	-25°C to $+105^{\circ}\text{C}$
Control Range with LM335	-40°C to $+100^{\circ}\text{C}$
Setting Resolution:	0.01°C
Measurement Resolution	0.01°C
Accuracy (except LM335)	$\pm 0.1^{\circ}\text{C}$
Temperature Stability 24 hours	$<0.002^{\circ}\text{C}$
Temperature Control Input	
Input Resistance	$10\ \text{k}\Omega$
Control Voltage	-10 V to $+10$ V
Transmission Coefficient Thermistor	
($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range)	$2\ \text{k}\Omega/\text{V}$ / $20\ \text{k}\Omega/\text{V} \pm 5\%$
Transmission Coefficient IC-Sensors	$20^{\circ}\text{C}/\text{V} \pm 5\%$
Temperature Control Output	
Load Resistance	$>10\ \text{k}\Omega$
Transmission Coefficient Thermistor	
($20\ \text{k}\Omega$ / $200\ \text{k}\Omega$ Range)	$500\ \text{mV}/\text{k}\Omega$ / $50\ \text{mV}/\text{k}\Omega \pm 5\%$
Transmission Coefficient IC-Sensors	$50\ \text{mV}/^{\circ}\text{C} \pm 5\%$
General Data	
Safety Features	TEC Current Limit, Short Circuit when TEC off, No Sensor Protection, Open Circuit Detection, Over Temperature Protection
Display	LED, 5 Digits
Connector for Sensor, TE Cooler, TEC On Signal:	15-pin D-sub Jack
Connectors for Control Input / Output	BNC
Chassis Ground Connector	4 mm Banana Jack
Line Voltage / Frequency	100 V, 115 V, 230 V $\pm 15\%$ -10% each / 50 to 60 Hz
Maximum Power Consumption	60 W
Operating Temperature	0 to $+40^{\circ}\text{C}$
Storage Temperature	-40 to $+70^{\circ}\text{C}$
Warm-up Time for Rated Accuracy	10 min
Weight	<3.1 kg
Dimensions (W x H x D) without Operating Elements	146 mm x 66 mm x 290 mm
Dimensions (W x H x D) with Operating Elements	146 mm x 77 mm x 320 mm

CHAPTER 2 LASERS

225 W TEC CONTROLLER



The TED4015 is a high performance digital temperature controller designed to drive thermoelectric cooler (TEC) elements with currents up to ± 15 A. It supports most common temperature sensors and can be adapted to different thermal loads. The TED4015 can be fully controlled via its robust SCPI compatible USB Interface. The digital PID control offers an auto PID setting function or separate control of the P, I, D parameters. The TED4015 boasts an excellent temperature stability of 0.002°C within 24 hrs, enhanced safeguard features, and error indicators, making this device ideal for cooling very sensitive devices where high stability, reliability, and precision is required.

Compared to the TED200 Series, the TED4015 Series Controller offers a wider TEC current range plus additional features like full digital control, easy auto PID setting, constant TEC current mode, set temperature protection, TEC voltage measurement, and adjustable temperature window protection. All of these features, the stylish new design and its silent operation make the TED4015 the perfect TEC controller for your application..

- Excellent Temperature Stability: 0.002°C (24 hrs)
- Digital PID Control with Separate P, I, D Settings
- Auto PID Setting Function
- Temperature Display in $^\circ\text{C}$, $^\circ\text{F}$, K
- Adjustable Temperature Sensor Offset
- Power Efficient by Active Power Management
- Compatible Sensors:
 - NTC-Thermistors
 - Current Temperature Sensors
 - Voltage Temperature Sensors
 - Platinum RTD Temperature Sensors
- Control Modes:
 - Constant Temperature
 - Constant Current
- Enhanced Security Features:
 - Adjustable TEC Current Limit
 - Adjustable Temperature Limits
 - Temperature Window Protection
 - Fault-Connection and Sensor Alarm
- Interface and Drivers:
 - USB Interface (SCPI compliant)
 - VXIbus/VISA Drivers for all Common Programming Environments like LabWindows/CVI™, LabVIEW™, and MS Visual Studio™

Item #	LDC4015
Temperature Stability	0.002°C (24 hrs)
TEC Output	± 15 A
Compliance Voltage	>15 V
Temperature Control Range	-55 to 150°C
Resistance Measurement Range (2 Ranges)	$100\ \Omega$ to $100\text{k}\ \Omega$ and 1k to $1\text{M}\ \Omega$
Temperature Resolution	0.001°C ($0.1\ \Omega/1\ \Omega$ for Thermistors)

ITC4000 SERIES LASER DIODE & TEMPERATURE CONTROLLER



TEC Controller Features

- Excellent Temperature Stability: 0.002 °C (24 hrs)
- Digital PID Control with Separate P, I, D Settings
- Auto PID Setting Function
- Adjustable Temperature Sensor Offset
- Compatible Temperature Sensors:
 - o NTC-Thermistors
 - o Current Temperature Sensors
 - o Voltage Temperature Sensors
 - o Platinum RTD Temperature Sensors
- TEC Control Modes:
 - o Constant Temperature
 - o Constant Current
- Enhanced TEC Security Features:
 - o Adjustable TEC Current Limit
 - o Adjustable Temperature Limits
 - o Temperature Window Protection
 - o Fault-Connection and Sensor Alarm

Laser Diode Controller Features

- Operate with Anode- or Cathode-Grounded Laser Diodes and Photodiodes
- Also Capable of Driving LEDs in CW
- Continuous Wave or Quasi-Continuous Wave Operation
- Internal Function Generator for Analog Modulation
- External Modulation Input
- Analog Monitor Output for the Laser Current
- Laser Diode Voltage Measurement
- Power Efficient by Active Power Management
- Compatible Optical Detectors:
 - o Photodiodes
 - o Thermopiles
 - o Common Sensor Amplifiers
 - o Power Meters with Voltage Output
- Laser Diode Control Modes:
 - o Constant Current (CC)
 - o Constant Power (CP)
- Enhanced Laser Diode Protection Features:
 - o Adjustable Laser Current Limit
 - o Adjustable Laser Power Limit
 - o Laser Over Voltage Protection
 - o Over Temperature Protection

The devices of the ITC4000 Series are a laser diode current controller combined with a TEC elements controller. Essentially this is a combination of a LDC4000 Series Current controller and a TED4015 Temperature Controller. It has been designed to provide a precise, stable current for laser diodes with injection currents of 1 A up to 20 A and an excellent temperature stabilization of 0.002 °C within 24 hrs. It supports all laser diode and monitor diode pin configurations and features a constant current (CC) or constant power (CP) mode. Most common temperature sensors can be used, and the ITC4000 can be adapted to different thermal loads via a digital PID controller. It offers an auto PID setting function or separate control of the P, I, and D parameters. For more details about these features please see the More Info tab.

The ITC4000 devices are controlled via front panel keys and intuitive operation menus on a large and easy-to-read graphic LCD display (See the Display Screens tab for some sample screens). Additionally, the ITC4000 Series can be controlled by a SCPI compatible USB Interface. A higher setting and measurement resolution is offered via remote control operation since the front panel resolution is limited by the resolution of the display. Various outputs and a digital I/O port offer many control and connectivity options. The built-in function generator allows analog modulation of the laser output out of the box.

Many enhanced features like the Quasi-Continuous Wave (QCW) operation mode, easy auto PID setting, and diverse laser diode and TEC element protection features are provided. (See the More Info tab) These features, together with the new design, provide silent and power-efficient operation, make the ITC4000 Series the ideal choice for the precise and secure operation of medium to high power laserdiodes and LEDs in lab and production environments.

Item #	ITC4001	ITC4005	ITC4020
Current Control Range	0 to 1 A	0 to 5 A	0 to 20 A
Compliance Voltage		>10 V	
Photocurrent Measurement Ranges		2 mA / 20 mA	
QCW* Mode Pulse Width Range		100 μs to 1 s	
QCW* Repetition Rate Range	1 ms to 5 s (0.2 to 1000 Hz)		
TEC Current Range	-8 to 8 A	-15 to 15 A	-15 to 15 A
TEC Compliance Voltage	>12V	>15 V	>15 V
TEC Output Power Max	>96 W	>225 W	>225 W
Temperature Range Max		-55 to 150 °C **	
Supported Temperature Sensors	Thermistors, Pt100, Pt1000, AD590, AD592, LM335, LM235, LM135, LM35		

* Quasi Continuous Wave

** The applicable control range depends on the sensor parameters.

CHAPTER 2 LASERS

MOUNTS FOR 5.6MM & 9MM LASER PACKAGES



TCLDM9 LD Mounts Specification:

- Laser Diode Packages: 5.6mm and 9mm
- Maximum Laser Current 2A
- Maximum TEC Current 5A
- Rf Modulation Frequency: 100kHz to 500MHz
- Polarity of Laser Diode: Anode or Cathode Ground
- 20 Watts Heating or Cooling Power
- Temperature Control Range 5 to 70°C
- 10kΩ NTC Thermistor and AD590 Temperature Sensor

The TCLDM9 mount is ideal for temperature-controlled operation of all 3- and 4-pin laser diodes in 9mm (TO18) and 5.6mm (TO46) packages including our pigtails. It includes a Bias-T for RF modulation of the laser current up to 500 MHz. The TCLDM9 can be easily integrated into any existing optical setup. It's front plate is equipped with tapped holes to mount our ER rods of the Cage Plate series mounting components and the bottom surface of the TCLDM9's provides 1/4-20 (M6) mounting holes.

The laser diode can be changed quickly. It is as simple as inserting the laser diode into the socket according to the imprinted pin assignment and fastening the clamp ring with three screws. The mount can be adapted to the polarity of laser diode and monitor diode by miniature switches.

The built-in TE cooler enables temperature-controlled operation of the laser diode. The clamp ring protects the laser diode against air draughts. Temperature stabilities about 10mK.

TEC-COOLED LASER DIODE MOUNT



LDM21 TEC-Cooled Laser Diode Mount Specification:

- Laser Diode Package: 5.6mm & 9mm
- Maximum Laser Current: 1A
- Polarity of Laser Diode: selectable
- Polarity of Monitor Diode: selectable
- Maximum TEC Current: 5A
- Temperature Sensor: 10kΩ Thermistor
- Temperature Range: 20°C -30°C

Introducing the LDM21 miniature TEC-Cooled Laser Diode Mount. Measuring half the size of our TCLDM9 mount, the LDM21 accepts both 5.6mm and 9mm laser diode packages. With an integrated thermal electric cooler element and a 10kohm thermistor this small laser mount will keep your laser wavelength stabilized by precisely holding the case temperature to within 0.002°C. Small enough to fit where other mounts can't go, the LDM21 is ideal for locating within an optical set-up where space is at a premium. Completely compatible with our extensive line of laser diode and TEC controllers, this mount can operate with all standard pin configurations of laser diodes.

The front side of the mount has a standard 1.035- 40 thread, making it compatible with SM1 series of optical components. This allows for the addition of collimating or focusing optics. The back side of the mount accepts inputs from the laser diode controller and TEC controller.

CHAPTER

2

LASERS

MOUNTS FOR BUTTERFLY LASER PACKAGES



- LM14S2 Butterfly Laser Mounts Specification:
- Maximum laser current : 5A
 - DPolarity of laser diode : AG
 - Polarity of monitor diode : floating
 - Maximum TEC current : 5A
 - Temperature sensor : thermistor
 - Temperature range (at 25°C With 2A TEC Current) : 0 to 70°C
 - Temperature coefficient of heat sink : 3°C/W
 - Dimensions : 3.5" x 3.5" x1.25"

The LM14S2 is designed to operate with ALL lasers in a 14 pin package. The top surface includes heat sink fins and a recessed region to mount the laser diode, resulting in a very low profile package. The LM14S2 also includes a laser diode “TEC Lockout” feature that disables the laser when the TEC controller is not active. It is designed to provide up to 5A laser current and 5A TEC current. Note: TEC control requires the laser package have an integrated TE cooler and thermal sensor.

This mount also provides zero insertion force sockets (ZIF), remote interlock connection, and an LED to indicate that the laser diode is enabled.

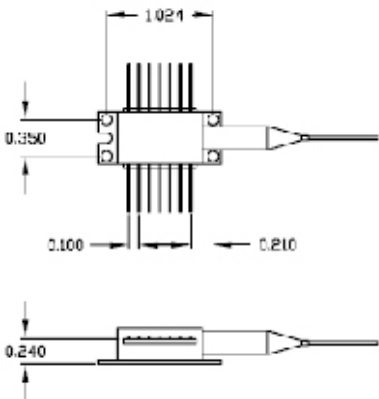
The LM14S2 mount is designed to operate a variety of laser diodes in the 14 pin butterfly packages. It does not have a fixed configuration and incorporates user definable configurations via modules that plug into a connector located in the bottom of the mount. Delivered with the LM14S2 are two modules: One is pre-configured for both Type 1 and Type 2 lasers, and one is a user configurable module designed to allow custom wiring of the mount.

In addition to the configurable pin-out feature, a Bias T adapter is included as an accessory, allowing for RF modulation of butterfly lasers specifically designed with this capability.



Pin Assignment of the 14-pin Sockets

Pin#	Connector (type 1)	Pin #	Connector (type2)
1	TEC anode	1	Thermistor ground
2	Thermistor	2	Thermistor
3	PD anode	3	LD cathode (DC)
4	PD cathode	4	PD anode
5	Thermistor ground	5	PD cathode
6	n.c.	6	TEC anode
7	PD cathode	7	TEC cathode
8	PD anode	8	LD anode , ground
9	LD cathode	9	LD anode , ground
10	LD anode , ground	10	n.c.
11	LD cathode	11	LD anode , ground
12	n.c.	12	LD cathode (RF)
13	LD anode , ground	13	LD anode , ground
14	TEC cathode	14	n.c.



CHAPTER 2 LASERS

INTUN™ SERIES TUNABLE LASERS



- Wavelength Ranges from 770 nm to 1650 nm
- Collimated Free Space Output Beam
- Instantaneous Linewidth of 120 kHz (Typical)
- USB 2.0 Interface
- SM1 and 30 mm Cage System Compatible
- Suitable for Spectroscopy and Interferometry

Thorlabs' INTUN Series of Tunable Lasers are designed for demanding applications such as spectroscopy. With four models spanning the wavelength range from 770 - 1650 nm, this family covers the widest spectral range of any of our tunable products. These truly continuously tunable lasers are optimized for step

and measurement applications, offer mode-hop-free operation, and have a convenient USB 2.0 interface.

Item #	TL780-B	TL980-B	TL1300-B	TL1550-B
Wavelength	780 nm	980 nm	1320 nm	1550 nm
Optical Power	>5 mW	>20 mW	>20 mW	>20 mW
Tuning Range	15 nm	25 nm	>110 nm	>150 nm
Tuning Speed Continuous	0 - 15 nm/s	0 - 15 nm/s	0 - 50 nm/s	0 - 50 nm/s
Wavelength Resolution		0.1 pm		
Wavelength Repeatability		1 pm		
Absolute Wavelength Accuracy		± 50 pm		
Wavelength Stability (1h/24hr)		± 2 pm / ± 10 pm		
Power Resolution		25 µW		
Spectral Linewidth		150 kHz Max*		
Effective Linewidth		1.5 MHz		
Coherence Control		1 GHz or 2 GHz		
Side Mode Suppression Ratio (SMSR)		45 dBc min		
Signal To Source		70 dB/nm**		
Spontaneous Emission Ratio (SSE)				
Signal To Source		65 dB		
Spontaneous Emission Ratio (STSSER)				
Relative Intensity Noise (RIN)		-140 (dB/Hz)		
Optical Output		Free-Space Collimated Beam		

* Measurement Time <1 ms. ** Application Dependent

Electrical and Interface Specifications

Parameter	INTUN-B
DC Input	+48 V/20 W
Analog Modulation Input	2 Vp-p
Analog Wavelength Output	0 - 4 V
Electrical Connectors	
DC Input Voltage	Rear Panel Socket
Digital Status	0 - 5 V
Interlock	DB9
Communications	USB 2.0
Analog Inputs	BNC
General	
Operating Temperature Range	15 to 30 °C
Dimensions	242 mm x 87 mm x 142 mm



See page 3-55

CHAPTER 2

LASERS

C&L BAND HIGH POWER WHITE

LIGHT SOURCE

- Additional L-Band power
- High power (30mW)
- Low noise

The ASE 730 White Light Test Source delivers more than +15dBm of output power across the C & L Band wavelengths (1530nm to 1610nm). The source satisfies the demand for higher power, longer wavelength test equipment for the growing L-Band market while also supporting the existing C-Band test instrumentation. The ASE730 is the lowest noise, high power C & L Band test source available today. Key features of all our ASE modules include low intensity noise, broadband output, and exceptional wavelength stability.

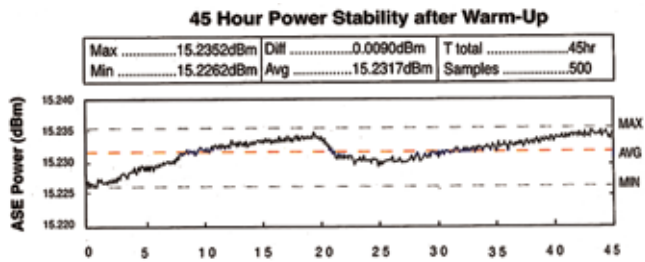


ASE730 OPTICAL SPECIFICATIONS

Total Output Power	>+15dBm(30mW)
	>-18dBm/nm@1530nm
Spectral Power Density(typical)	>-11dBm/nm@1540-1600nm
	>-18dBm/nm@1610nm
Output Power Stability (typical)	±0.001dB(15min.after 1 hour warmup)
	±0.005dB Maximum

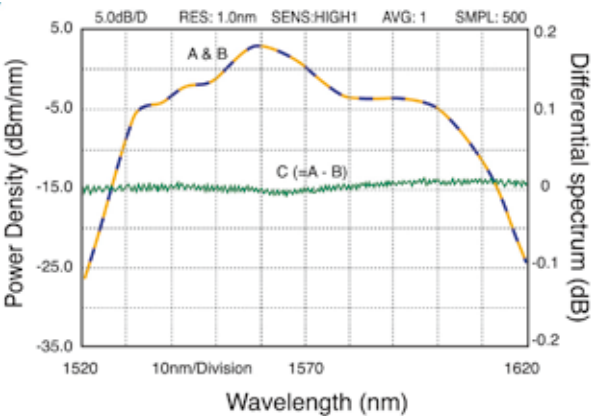
GENERAL SPECIFICATIONS

Output Fiber	SMF-28
Size(mm)	88(H)x230(W)x352(D)
Operation Temperature	0°C to 40°C
Storage Temperature	-10°C to 45°C



Power stability plots, 15 minute and 45 hour time intervals

Output spectrum

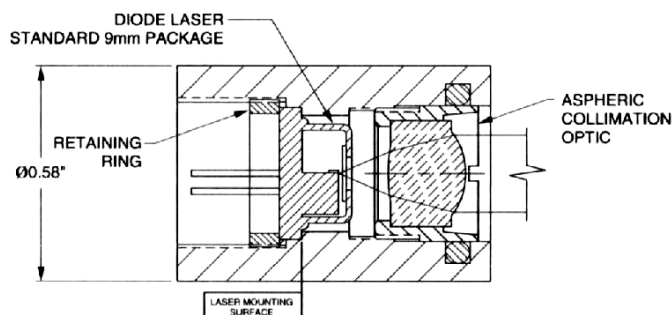


Differential spectrum showing power stability over a 15 minute time interval

CHAPTER 2 LASERS

COLLIMATION OPTICS

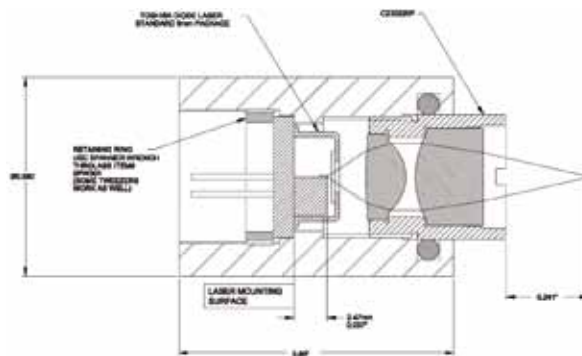
Collimation tubes & optics: 5.6mm & 9mm laser packages



- Precision Mount for Standard 9mm and 5.6mm Laser Packages
- Diffraction-Limited Aspheric Collimation Optic with Multi-Layer Broadband AR coating
- Threaded Retaining Ring Holds Laser in Collimation Tube. Lasers can be Easily Replaced
- Precision Lens Mount with Adjustable Focus
- Includes Main Tube & Optic & Retaining Ring & Rubber O-Ring and adapter for 5.6mm packages

ITEM#	WAVELENGTH RENG	PACKAGE LENGTH	NUMERIC APERTURE
LT110P-B	600-1050nm	0.85"	0.40
LT220P-B	600-1050nm	1.00"	0.25
LT230P-B	600-1050nm	0.75"	0.55
LT240P-B	600-1050nm	0.95"	0.50

Focusing tube & optics: 5.6mm & 9mm laser package



LT230220P Magnification:2.44 Image NA:0.22Max

LT230260P Magnification:3.41 Image NA:0.16Max

ITEM#	DESCRIPTION	L
LT230220P-B	Laser Tube with C230220P-B Optic Pair	
LT230260P-B	Laser Tube with C230260P-B Optic Pair	