

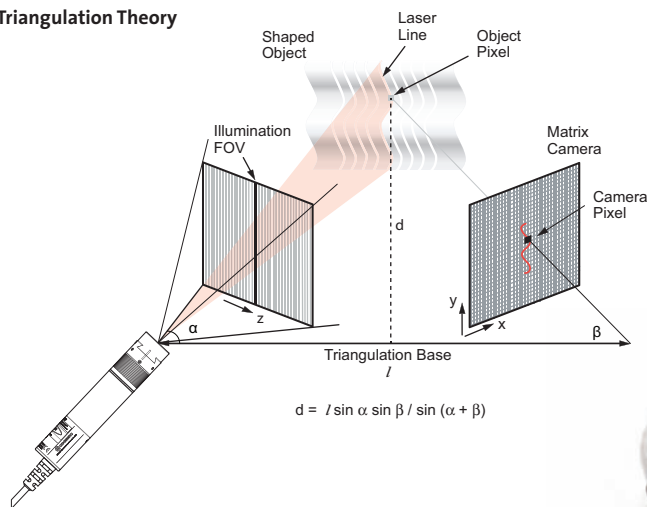
# Coherent StingRay

Structured Light Pattern Generating Laser

In today's world of expanding 3D vision systems, the camera and laser are equal partners in the accuracy, stability and repeatability of the measurements made and used by these applications. The requirements on the laser for uniformity, power, pointing and electrical stability are far above a typical illumination system requirements. Having a source which produces very high power density, very thin measurement cross sections with a uniform return that does not mask the profile of the object is critical to the continued success of these demanding applications. The technology and advancement of these lasers has stayed the same for many years now, not giving the user the ability to leverage this portion of the system beyond its current technology.

The Coherent StingRay laser platform is a re-vision of this technology, taking technology and best practices from leading edge applications in Bioinstrumentation and Laser Measurement and Control. The Coherent StingRay laser incorporates state of the art electronics, optics and mechanics to provide a compact, highly flexible and reliable laser source that re-sets the standard in Machine Vision.

## 3D Triangulation Theory



## Coherent StingRay Features:

- 450 nm to 830 nm
- Power up to 200 mW
- Uniformity up to 95%
- External focusability
- Pointing <math><10 \mu\text{rad}/^\circ\text{C}</math>
- Microprocessor controlled
- Advanced service monitor
- RS-232 controllable with GUI interface
- Auto scaling input power 5 to 24 VDC

## Coherent StingRay Applications:

- Non-contact Height Measurements
- Automotive Production
- Extrusion Measurements
- Medical/Dental
- Transportation
- Wood Processing
- Steel Production
- Microelectronics Inspection
- Food Portioning/Inspection
- Glass Inspection

Superior Reliability & Performance

[www.Coherent.com/CoherentStingRay](http://www.Coherent.com/CoherentStingRay)

# Coherent StingRay

## Structured Light Pattern Generating Laser

### System Specifications

	Coherent StingRay-450	Coherent StingRay-520	Coherent StingRay-639	Coherent StingRay-640	Coherent StingRay-655
Wavelength <sup>1</sup> (nm)	450	520	639	640	655
Wavelength Tolerance (±nm)	±5	+10/-5	+4/-9	±2	±5
Output Power (mW - Max. <sup>2</sup> )	50	50	10	35	5
Spatial Mode	TEM <sub>00</sub>				
M <sup>2</sup> (Beam Quality)	<1.5				
Fan Angles (degrees at 80% clip)	1, 5, 10, 20, 30, 45, 60, 75				
Straightness (%) >25 mm Line	0.1				
Pointing Stability Over Temp. (μrad/°C)	<10				
RMS Noise (%) (20 Hz to 20 MHz)	<0.5				
Peak-to-Peak Noise (%) (20 Hz to 20 MHz)	<1				
Long-Term Power Stability (%) (8 hrs., ±3°C)	<2				
Warm-Up Time (minutes) (from Cold Start)	<5				
Laser Drive Modes	CW, Analog, Digital, Fast Digital				
Digital Modulation					
Maximum Bandwidth (kHz)	100 (Constant Power)				
Rise Time (10% to 90%) (nsec)	<700				
Fall Time (90% to 10%) (nsec)	<700				
Modulation Depth (%)	100				
Operation Range (VDC)	0 to 1 Off - 4 to 5 On / 0 to 1 On - 4 to 5 Off				
Fast Digital Modulation <sup>3</sup>					
Maximum Bandwidth (MHz)	2				
Rise Time (10% to 90%) (nsec)	<50				
Fall Time (90% to 10%) (nsec)	<50				
Modulation Depth (%)	100				
Operation Range (VDC)	0 to 1 Off - 4 to 5 On / 0 to 1 On - 4 to 5 Off				
Analog Modulation					
Maximum Bandwidth (KHz)	500 (Constant Power)				
Rise Time (10% to 90%) (nsec)	<500				
Fall Time (90% to 10%) (nsec)	<500				
Modulation Depth (%)	100				
Linear Range (VDC)	0.5 to 5 / 0 to 4.5				
Operating Voltage <sup>4</sup> (VDC)	5 to 24				
Operating Current (mA) - (Max. at 25°C)	150	200	100	160	85
Connector (optional)	Hirose HR-10P-12S				
Slow Start Delay <sup>5</sup> (msec)	5				
Input Impedance (kOhm)	1.5				
Beam Angle (mrad)	<3				
ESD Protection	Level 4				
Power Consumption (W)	5 Max.		3 Max.		
Heat Dissipation of Laser Head (W)	5 Max.		3 Max.		
Ambient Temperature					
Operating Condition <sup>6</sup> (°C)	-10 to 50				
Non-Operating Condition (°C)	-20 to 60				
Shock Tolerance (g) (6 ms)	30				

<sup>1</sup> Center Wavelength at 25°C.

<sup>2</sup> Delivered power.

<sup>3</sup> Constant current configuration only.

<sup>4</sup> 520 nm lasers have best efficiency >12 VDC.

<sup>5</sup> If enabled.

<sup>6</sup> 520 nm lasers are 10 to 40°C.

# Coherent StingRay

## Structured Light Pattern Generating Laser

### System Specifications

	Coherent StingRay-660	Coherent StingRay-660	Coherent StingRay-660	Coherent StingRay-685	Coherent StingRay-785	Coherent StingRay-830
Wavelength <sup>1</sup> (nm)	660	660	660	685	785	830
Wavelength Tolerance (±nm)	+7/-10	+6	+6	±15	±10	+10
Output Power (mW - Max.)	35	50	100	50	90	200
Spatial Mode	TEM <sub>00</sub>					
M <sup>2</sup> (Beam Quality)	<1.5					
Fan Angles (degrees at 80% clip)	1, 5, 10, 20, 30, 45, 60, 75, 90					
Straightness (%) >25 mm Line	0.1					
Pointing Stability Over Temp. (μrad/°C)	<10					
RMS Noise (%) (20 Hz to 20 MHz)	<0.5					
Peak-to-Peak Noise (%) (20 Hz to 20 MHz)	<1					
Long-Term Power Stability (%) (8 hrs., ±3°C)	<2					
Warm-Up Time (minutes) (from Cold Start)	<5					
Laser Drive Modes	CW, Analog, Digital, Fast Digital					
Digital Modulation						
Maximum Bandwidth (kHz)	100 (Constant Power)					
Rise Time (10% to 90%) (nsec)	<700					
Fall Time (90% to 10%) (nsec)	<700					
Modulation Depth (%)	100					
Operation Range (VDC)	0 to 1 Off - 4 to 5 On / 0 to 1 On - 4 to 5 Off					
Fast Digital Modulation <sup>2</sup>						
Maximum Bandwidth (MHz)	2					
Rise Time (10% to 90%) (nsec)	<50					
Fall Time (90% to 10%) (nsec)	<50					
Modulation Depth (%)	100					
Operation Range (VDC)	0 to 1 Off - 4 to 5 On / 0 to 1 On - 4 to 5 Off					
Analog Modulation						
Maximum Bandwidth (KHz)	500 (Constant Power)					
Rise Time (10% to 90%) (nsec)	<500					
Fall Time (90% to 10%) (nsec)	<500					
Modulation Depth (%)	100					
Linear Range (VDC)	0.5 to 5 / 0 to 4.5					
Operating Voltage (VDC)	5 to 24					
Operating Current (mA) - (Max. at 25°C)	135	185	260	190	210	350
Connector (optional)	Hirose HR-10P-12S					
Slow Start Delay <sup>3</sup> (msec)	5					
Input Impedance (kOhm)	1.5					
Beam Angle (mrad)	<3					
ESD Protection	Level 4					
Power Consumption (W)	3 Max.					
Heat Dissipation of Laser Head (W)	3 Max.					
Ambient Temperature						
Operating Condition (°C)	-10 to 50					
Non-Operating Condition (°C)	-20 to 60					
Shock Tolerance (g) (6 ms)	30					

<sup>1</sup> Center Wavelength at 25°C.

<sup>2</sup> Constant current configuration only.

<sup>3</sup> If enabled.

# Coherent StingRay

## Structured Light Pattern Generating Laser

### Mechanical Specifications

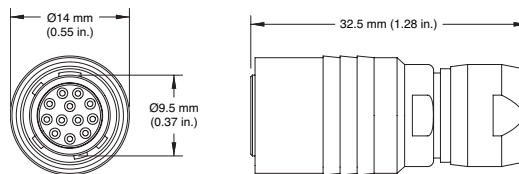
Weight (g)	<70
Length <sup>1</sup> (mm)	95/98
Diameter (mm)	19.05
Material	Black anodized AL 6061 T1

### RS-232 Commands<sup>2</sup>

Commands	Description
CDRH	Enables/Disables CDRH Delay
BAUD	Set Baud Rate
HAND	Enables/Disables SCPI Handshaking
HOUR	Reports System Lasing Hours
MOD	Reports Laser Model
PNUM	Reports Part Number
SNUM	Reports Serial Number
USER	Stores User Defined Identification
POW:LEV	Reports Diode Laser Power
DIOD	Reports Diode Temperature
INT	Reports Internal Temperature
HIGH	Reports Diode High Temperature Set
MPOL	Sets Modulation Polarity
AMPL	Sets Laser Output Power
STAT	Reports System Status
CUR:LEV	Reports Diode Current

### Pinout

Color	Description	Pin (optional Hirose connector)
Standard		
Red	V <sub>in</sub>	9
Black	V <sub>in</sub> Gnd	1
Green	Fault	10
Optional		
White	RS232 Recv	4
White/Black	RS232 Gnd	5
Orange	RS232 Trans	6
Blue	V <sub>mod</sub>	2
Red/Black	V <sub>mod</sub> Gnd	3



### Available Patterns<sup>3</sup>

<sup>1</sup> 95 mm for Standard Configuration, 98 mm for Accessory Configuration.

<sup>2</sup> See Users manual for full Host command set.

<sup>3</sup> Other Patterns available upon request, contact your local Coherent Sales resource.

#### Single Line



#### Cross Hair



#### Dot Line



#### 7x7 Dot Matrix



#### Single Dot



#### Parallel Lines



#### 4x4 Grid



#### Single Circle



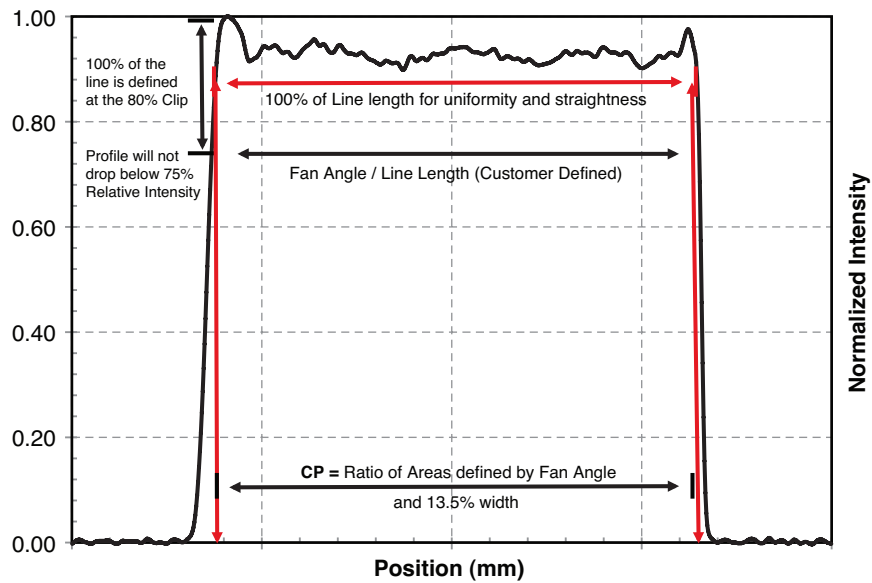
#### 7 Concentric Circles



# Coherent StingRay

Structured Light Pattern Generating Laser

## Flat-Top Intensity Profile



### Definitions

#### Uniformity

Max relative intensity variation over 100% of the line

$$U = (I_{max} - I_{min}) \div (I_{max} + I_{min})$$

#### Contained Power

Power contained in the 100% line at the 80% Clip versus the power contained in the 13.5% Clip

$$CP = 80\%P \div 13.5\%P$$

#### Line Length / Fan Angle

FA is the angle of the projection taken at the 80% Clip

Line length is the physical length at a given working distance taken at the 80% Clip

#### Relative Illumination Floor

This is the minimum relative intensity at any point on the define line length

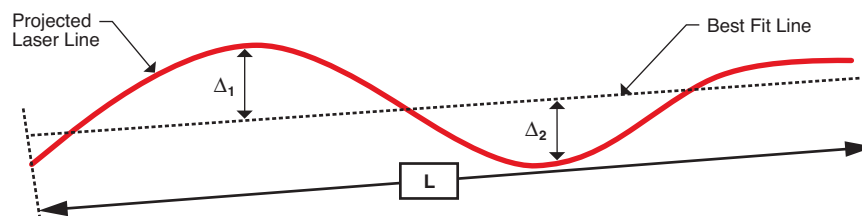
Measured as a percent of the normalized intensity

#### Straightness

Deviation from best fit line

$$\Delta = \Delta_1 + \Delta_2$$

$$S = (\Delta/L) * 100$$



# Coherent StingRay

## Structured Light Pattern Generating Laser

### Fault Conditions

Built-in microcontroller probes most critical parameters of the circuit with ADCs such as:

- Temperature
  - Photodiode output voltage
  - Laser diode voltage
  - Laser diode current
  - Value of inverted and non-inverted modulating signal in case of Coherent StingRay-AM and Coherent StingRay-DM product options.

Based on the results of the parameter measurement microcontroller can detect following fault conditions

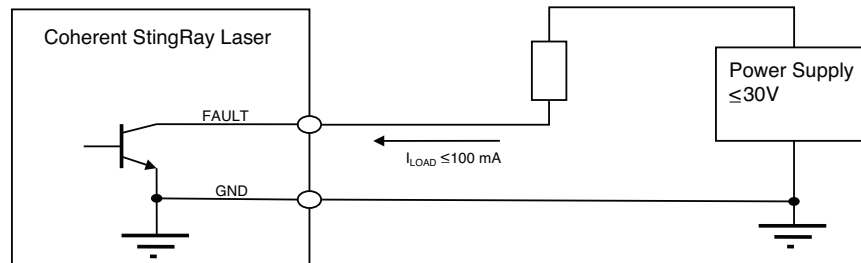
- Over temperature
- Circuit malfunction
- Absence of the input modulating signal
- Critical drop of laser diode output power due to aging

### Fault Output Circuit<sup>1</sup>

Fault output is an open collector of the transistor that allows wire junction OR functionality with fault signals from other devices. The output can tolerate voltage up to 30V and can drain the current up to 100 mA. The circuit is protected from over current by recoverable fuse.

The load should be connected between the voltage source and the open collector output as shown Figure 1.

Figure 1

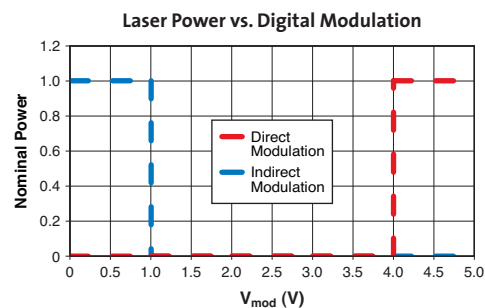
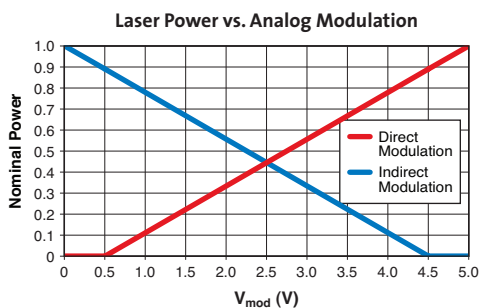


<sup>1</sup> Not available with Fast TTL configuration.

### Modulation Timing<sup>2</sup>

Modulation	Fmax	VDC	
		Direct (VDC)	Inverse (VDC)
Analog	500 KHz	0 to 0.5	4.5 to 5
		OFF	
		0.5 to 5	0 to 4.5
		Linear Region	
TTL	100 KHz	0 to 1	4 to 5
		OFF	
		4 to 5	0 to 1
		ON	
Fast TTL	2 MHz	1 to 4	1 to 4
		UNDEFINED	
		0 to 1	4 to 5
		OFF	
Fast TTL	2 MHz	4 to 5	0 to 1
		ON	
		1 to 4	1 to 4
		UNDEFINED	

<sup>2</sup> Lasers equipped with modulation must have a load on the modulation input for proper operation.



# Coherent StingRay

## Structured Light Pattern Generating Laser

### Model Configuration: STR-Wav-Pwr-Mod-Cable-Optic-IA-FA-Focus-Comm-Opt

Product Line	Wavelength	Power	Modulation	Cable
STR	450	1	A <sup>1</sup>	FL <sup>2</sup>
	520	5	RA <sup>3</sup>	HR <sup>4</sup>
	640	10	T <sup>5</sup>	P <sup>6</sup>
	660	20	FT <sup>7</sup>	B <sup>8</sup>
	685	35	RT <sup>9</sup>	
	785	50	RFT <sup>10</sup>	
	830	75		
		100		
		150		
		200		

Optic	Interbeam Angle	Fan Angle	Focus <sup>11</sup>	COMM
L <sup>12</sup> 01	0.07	1	S <sup>13</sup>	Tx <sup>14</sup>
H <sup>15</sup> 03	0.09	5	E <sup>16</sup>	
C <sup>17</sup> 04	0.11	10		
M <sup>18</sup> 05	0.15	15		
G <sup>19</sup> 07	0.23	20		
SQ <sup>20</sup> 09	0.38	30		
D <sup>21</sup> 11	0.41	45		
	0.5	60		
	0.77	75		
	1.11			
	1.5			
	1.9			
	2.34			
	5			
	5.4			
	9.7			
11.4				
11.7				

### Option

- 1 - Custom Focus Distance (100 mm to 2000 mm)
- 2 - Uniformity/Straightness Measurement
- 3 - Safety Class Adjustment
- 4 - Delivered Power Adjustment

### Ordering Information

	01 L/D	03 L/D	05 L/D	07 L/D	09 L/D
Pattern	1 Line / Dot	3 Lines / Dots	5 Lines / Dots	7 Lines / Dots	9 Lines / Dots
Intrabeam Angle	-	1.5, 5, 11.7	0.23, 1.55	5, 8.75	0.07, 0.11
	11 L/D	15 L/D	19 L/D	33 L/D	65 L/D
Pattern	11 Lines / Dots	15 Lines / Dots	19 Line / Dots	33 Lines / Dots	65 Lines / Dots
Intrabeam Angle	1.5	2.3	0.77	0.09, 0.38	0.41
	99 L/D	SQ1	G44	01H	C01
Pattern	99 Lines / Dots	1 Square	4 x 4 Grid	Cross Hair	1 Circle
Intrabeam Angle	0.149	2.9	2.44	-	0.77, 11.4
	CC7	M77	M19	Custom	
Pattern	7 Circles	7 x 7 dot matrix	19 x 19 dot matrix		
Intrabeam Angle	0.77	1.9	0.77		
Wavelength	450	520	640	655	660
Diode Power	5, 10, 20, 35, 50	5, 10, 20, 35, 50	1, 5, 10, 20, 35	1, 5	10, 20, 35, 50, 100
Wavelength	685	785	830		
Diode Power	20, 35, 50	35, 75, 90	100, 150, 200		

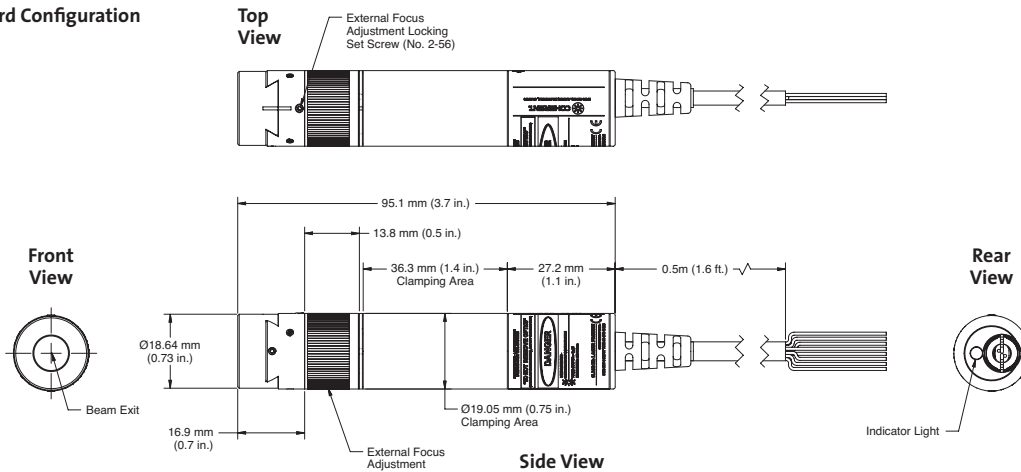
<sup>1</sup> A = Analog. <sup>2</sup> FL = Flying Lead Cable. <sup>3</sup> RA = Reverse Analog. <sup>4</sup> HR = Hirose Cable. <sup>5</sup> T = Digital. <sup>6</sup> P = Legacy Power Cable. <sup>7</sup> FT = Fast Digital. <sup>8</sup> B = Legacy Power and BNC Cable. <sup>9</sup> RT = Reverse Digital. <sup>10</sup> RFT = Reverse Fast Digital. <sup>11</sup> "S" focus is fast axis. "E" focus is slow axis. <sup>12</sup> L = Line. <sup>13</sup> S = Standard. <sup>14</sup> Tx = RS-232 Option. <sup>15</sup> H = Cross Hair. <sup>16</sup> E = Extended. <sup>17</sup> C = Circle. <sup>18</sup> M = Matrix. <sup>19</sup> G = Grid. <sup>20</sup> SQ = Square. <sup>21</sup> D = Dot.

# Coherent StingRay

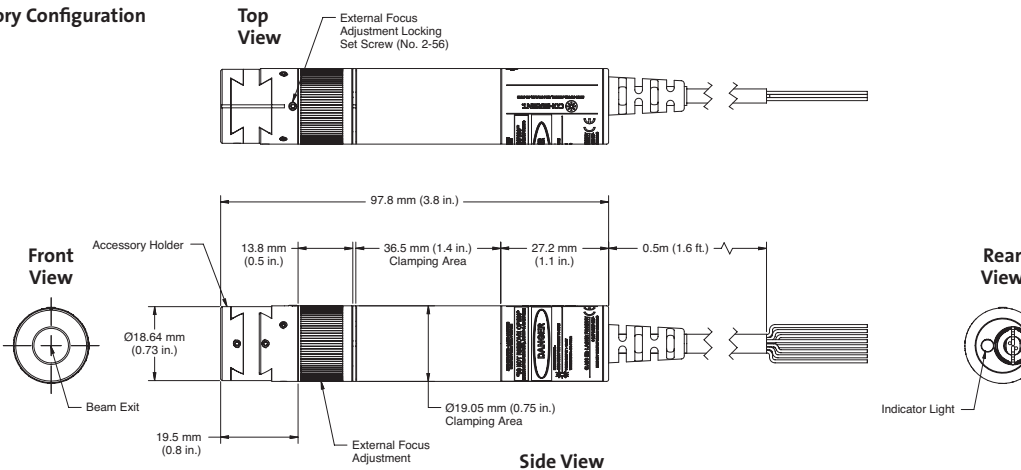
## Structured Light Pattern Generating Laser

### Mechanical Specifications

#### Standard Configuration



#### Accessory Configuration



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Coherent follows a policy of continuous product improvement. Specifications are subject to change without notice.

Coherent's scientific and industrial lasers are certified to comply with the Federal Regulations (21 CFR Subchapter J) as administered by the Center for Devices and Radiological Health on all systems ordered for shipment after August 2, 1976.

Coherent offers a limited warranty for all Coherent StingRay lasers. For full details of this warranty coverage, please refer to the Service section at www.Coherent.com or contact your local Sales or Service Representative.

