

RIO ORION™ Series 1550nm Low Phase Noise Narrow Linewidth Laser Module

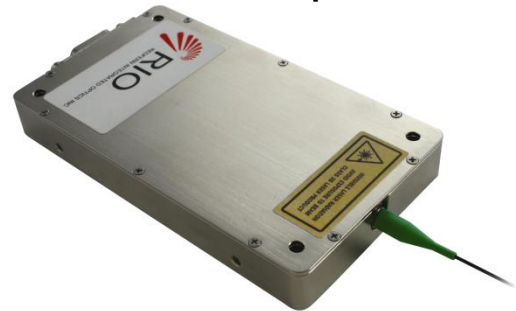
Key features

- Single longitudinal mode
- Center wavelength: 1530nm-1565nm, ITU-T DWDM 100 GHz C-band or custom
- Very low phase noise
- Very narrow linewidth, long coherence length
- Ultra low RIN
- Excellent SMSR
- Unmatched wavelength stability over life and temperature
- Wavelength tunability
- Direct power modulation
- Very low sensitivity to vibration and acoustic noise
- SMF and PM fiber pigtail options
- Compact size, low power dissipation
- Easy to set-up and use
- Digital controller and firmware with multiple interface options (SPI, RS-232, RS-485)
- Telcordia GR-468 qualified
- RoHS compliant

Applications

- Acoustic & seismic interferometric fiber optic sensing
- Defense and security
- Oil & Gas – exploration and production
- LIDAR
- Metrology
- RF and microwave photonics
- Coherent Communications

Data Sheet
September 2012



Description

The ORION™ devices are compact laser modules employing the RIO high-performance External Cavity Laser (ECL). This laser design is based on RIO's proprietary planar technology (**PLANEX™**) and consists of a gain chip and a planar lightwave circuit including waveguides with Bragg gratings, forming a laser cavity with significant advantages.

The ORION™ modules provide a stable, self-contained, easy-to-use alternative to complicated, sensitive to the ambient environment and expensive fiber laser sources, or other narrow linewidth laser alternatives.

The ORION™ module uses reliable, Telcordia qualified and industry proven components, and employs low noise, digital laser bias current and temperature control circuitry to set and monitor laser performance. External monitoring and control can be accomplished via a standard interfaces, using RIO-supplied software. The ORION™ module is an ideal source for commercial and other fiber optic sensing applications, such as interferometric and Brillouin DTSS systems for oil & gas, security and smart infrastructures monitoring, coherent Doppler LIDAR for wind measurements, coherent and heterodyne metrology, photonic velocimetry and vibrometry, and coherent communications.

Absolute Maximum Ratings

Operation of the device beyond these maximum conditions may degrade device performance, lead to device failure, shorter lifetime, and will invalidate the device warranty.

Parameter	Min	Max	Unit
Storage temperature	- 40	+ 85	°C
Module supply voltage		5.5	V
ESD-susceptibility		500	V
Fiber bend radius	35		mm
Tensile strength, fiber to the package		5	N

Optical and Electrical Specifications

At recommended TEC set temperature T_s and bias current I_b

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Optical Power	P_{out}	CW	See ordering information			mW
Power Stability over case temperature range ¹	dP_{out}	0 to +70 °C		±10		%
		+10 to +55 °C		±5		
		≤ ±1 °C			±0.3	
Center Wavelength (ITU grid)	λ	± 40 pm standard ²	1530		1565	nm
Wavelength tuning range ³	$\Delta\lambda_T$	via TEC temperature change	30			pm
Wavelength stability over case temperature range ¹	$d\lambda$	0 to +70 °C		±10		pm
		+10 to +55 °C		±5		
		≤ ±1 °C			±0.5	
Relative Intensity Noise	RIN	≥ 1kHz			-140	dB/Hz
		≥ 500 kHz	Shot noise limited			
Side Mode Suppression Ratio	SMSR	CW, at specified P_{out}	40			dB
Optical S/N Ratio	S/N	From spontaneous noise levels at +/-1 nm from λ	60			dB
Polarization Extinction Ratio ⁴	PER	For PM option, polarization and connector key aligned to slow axis	20			dB
Optical Isolation	ISO		40			dB
Voltage Supply	V_{cc}		4.75	5	5.25	V

1. Customized power and wavelength stability requirements are available upon request.
2. Customized center wavelength and set resolution, including ITU-T C-band is available. See ordering information page
3. Phase continuous wavelength tuning by changing TEC temperature settings. Some performance parameters will change over tuning range.
4. With PM-fiber PANDA option. See ordering information page.

Frequency Stability and Modulation Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Frequency stability ¹	ν_{11}	Free running, over 1 hour		± 2	± 4	MHz
	ν_{18}	Free running, over 8 hours		± 3	± 6	
Fast frequency modulation bandwidth	f_m	Sinusoidal modulation	DC		100 ³	kHz
Frequency fast tuning range ^{2,3}	$\Delta\nu$	Sinusoidal modulation at 10 kHz; input voltage 4V p-p	100	200		MHz p-p
Frequency fast tuning efficiency ³	η_m	Sinusoidal modulation at 10 kHz	25	50		MHz/V
Tuning voltage magnitude	V_{tune}		-4		+4	V
Output power modulation index ²	M	Sinusoidal modulation at 10 kHz; wavelength tuning 100 MHz p-p		5	10	%

1. After 1 hour stabilization, tested with heterodyning of two lasers at constant case temperature.
2. Frequency will lead to modulation of output power.
3. Tuning efficiency will vary over modulation bandwidth. Contact RIO for more information.

Linewidth and Phase Noise Specifications

At recommended TEC set temperature T_s and bias current I_b ,

Parameter	Symbol	Conditions	Grade 1	Grade 3	Grade 4	Grade 5 ³	Unit
Spectral Linewidth, FWHM ¹	$\Delta\lambda_L$		≤ 15	≤ 5	≤ 2	≤ 1	kHz
Phase Noise Typical Values ²	PhN	@ 10 Hz	123	41	20	10	$\mu\text{rad}/\text{rt-Hz}$ 1 m OPD
		@ 200 Hz	22	8	4	2	

1. Value based on Lorentzian linewidth model.

2. As measured with RIO's interferometric phase noise test setup, 1m OPD in the SM fiber.

3. 10 mW output power version only.

Thermal Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Operating temperature range (case)	T_c		0		+ 70	$^{\circ}\text{C}$
Power Dissipation	P_{dt}	At 50 $^{\circ}\text{C}$ case temperature		4		W
Power Dissipation	P_d	Over case temperature range			6	W
Total current	I_{max}	Over case temperature range			1.5	A

Connectors

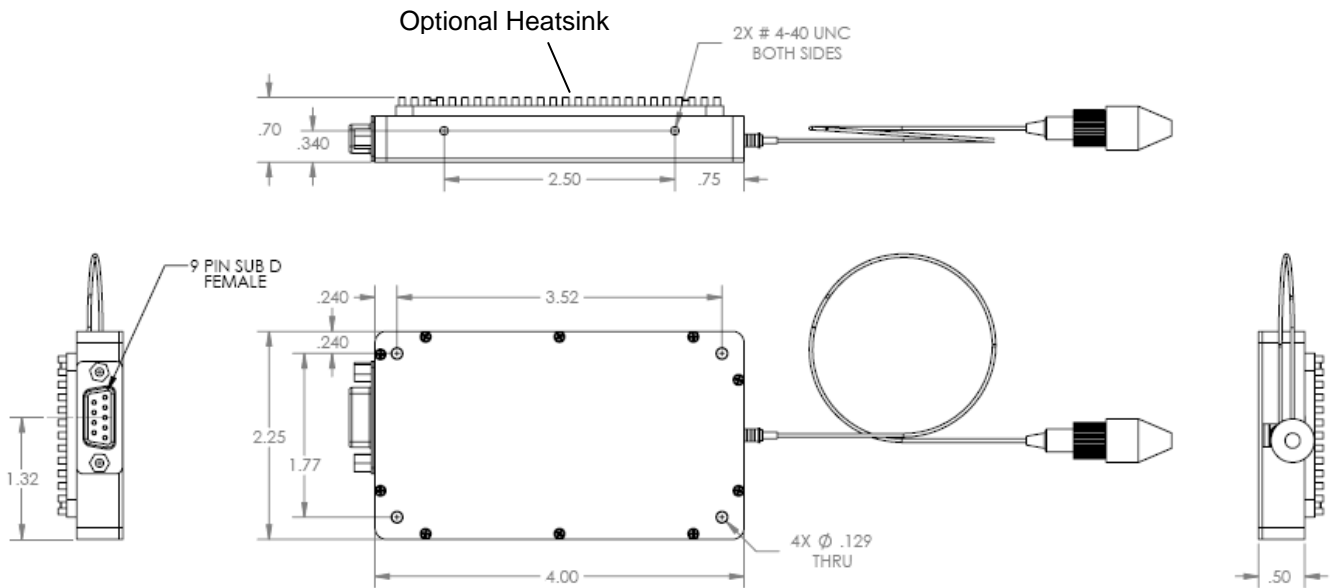
#	Description
A	FC/APC connector on pigtailed fiber.
B	Interface D-9 Female connector for power supply, external monitoring and control. Control Interface

Interface connector B

Pin #	Function SPI	Function RS-232	Function RS-485	Note
1	Vcc +5V	Vcc +5V	Vcc +5V	4.75 V Min, 5.25V Max, Regulated, Low noise (<100mVp-p)
2	MISO (output)	Tx	Data +; 1 k Ω diff impedance	
3	MOSI (input)	Rx	Data -; 1 k Ω diff impedance	
4	Modulation (input)	Modulation (input)	Modulation (input)	1 k Ω impedance
5	GND	GND	GND	
6	/Ready-Warning (output)	/Ready-Warning (output)	/Ready-Warning (output)	Active low, needs external pull up
7	/SPI SS (input)	Not used	Not used	3.3 to 5V TTL compatible
8	SPI CLK (input)	Not used	Not used	3.3 to 5V TTL compatible
9	/Enable (input)	/Enable (input)	/Enable (input)	12K internal pull up to Vcc (active low)
Configuration	4-wire SPI slave. Bit order: MSB first. Bit rate: ≤ 2 MHz . MISO and MOSI: 3.3V drive, TTL level compatible, data centered on rising clk. /SS: Slave Select (active low). CLK: Idle state is low, data clocked on rising edge.	9600 Baud. 8 Data Bits. No Parity Bit. 1 Stop Bit. No Flow Control. TTL asynchronous serial option available at request	9600 Baud. 8 Data Bits. No Parity Bit. 1 Stop Bit. No Flow Control.	

Mechanical Diagram

Units: Inch



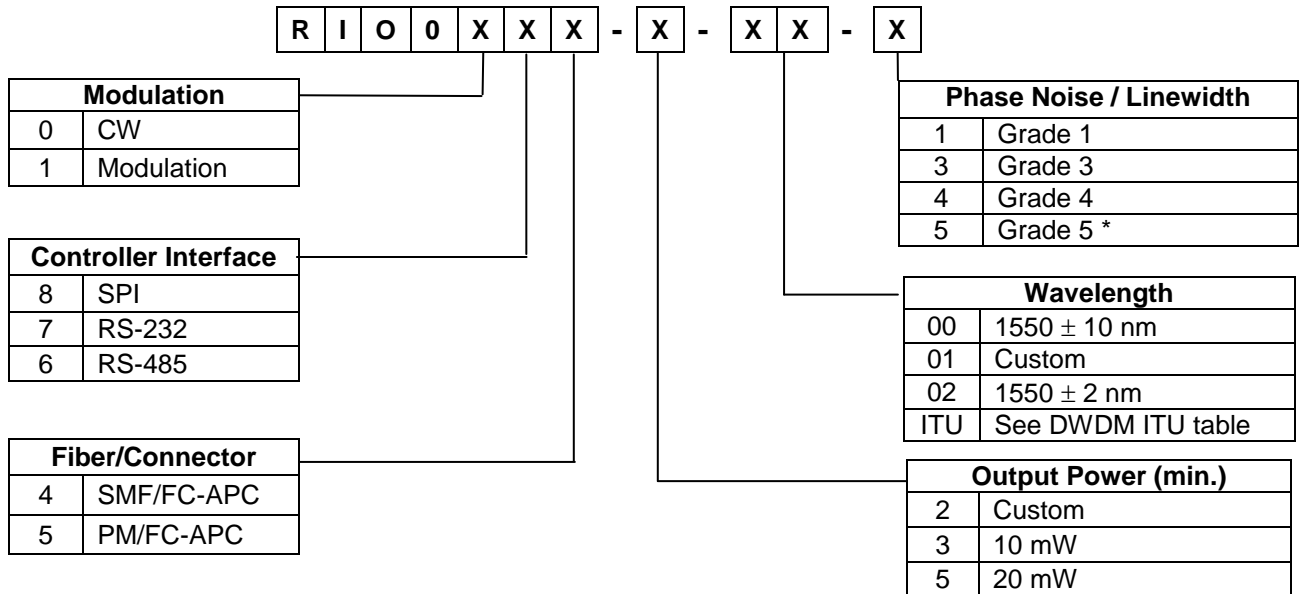
ORION Housing Material Options:

- Electroless Nickel-plated Aluminum (standard)
- Nickel-plated Copper (optional)

Reliability and Certifications

- Qualified according to Telcordia GR-468-CORE
- CE certified

Ordering Information



* Grade 5: 10 mW output power version only

Rev.0.2.2

Proprietary Information

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Accessories



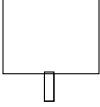
Accessory PN	Description
RIO008X-KIT	5V DC power supply, CD w/ GUI & USB/SPI Aardvark adaptor with cable
RIO018X-KIT	5V DC power supply, CD w/ GUI & USB/SPI Aardvark adaptor with cable (DM Tunable)
RIO007X-KIT	5V DC power supply, CD w/ GUI & RS232 interface cable
RIO017X-KIT	5V DC power supply, CD w/ GUI & RS232 interface cable (DM Tunable)
RIO006X-KIT	5V DC power supply, CD w/ GUI & RS485 interface cable
RIO016X-KIT	5V DC power supply, CD w/ GUI & RS485 interface cable (DM Tunable)
RIO0HS	External heatsink w/ hardware

DWDM ITU Wavelength

ITU channel number	ITU Frequency THz	Wavelength nm	ITU channel number	ITU Frequency THz	Wavelength nm	ITU channel number	ITU Frequency THz	Wavelength nm
15	191.50	1565.50	30	193.00	1553.33	45	194.50	1541.35
16	191.60	1564.68	31	193.10	1552.52	46	194.60	1540.56
17	191.70	1563.86	32	193.20	1551.72	47	194.70	1539.77
18	191.80	1563.05	33	193.30	1550.92	48	194.80	1538.98
19	191.90	1562.23	34	193.40	1550.12	49	194.90	1538.19
20	192.00	1561.42	35	193.50	1549.32	50	195.00	1537.40
21	192.10	1560.61	36	193.60	1548.51	51	195.10	1536.61
22	192.20	1559.79	37	193.70	1547.72	52	195.20	1535.82
23	192.30	1558.98	38	193.80	1546.92	53	195.30	1535.04
24	192.40	1558.17	39	193.90	1546.12	54	195.40	1534.25
25	192.50	1557.36	40	194.00	1545.32	55	195.50	1533.47
26	192.60	1556.55	41	194.10	1544.53	56	195.60	1532.68
27	192.70	1555.75	42	194.20	1543.73	57	195.70	1531.90
28	192.80	1554.94	43	194.30	1542.94	58	195.80	1531.12
29	192.90	1554.13	44	194.40	1542.14	59	195.90	1530.33

Laser Safety Information

The ORION Laser Module is classified as FDA/CDRH Class IIIb laser products per CDRH, 21 CFR 1040 laser safety requirements.

 <p>DANGER</p> <p>INVISIBLE LASER RADIATION BEAM</p>  <p>MAX. OUTPUT POWER: 20 mW WAVELENGTH: 1.5 μm CLASS III b LASER PRODUCT</p>	<p>LASER APERTURE</p>  <p>AVOID EXPOSURE Invisible laser radiation is emitted from end of fiber or connector</p>
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