

RIO ORION™ Series 1550nm Low Phase Noise

Narrow Linewidth Laser Source

Key features

- Single longitudinal mode
- Center wavelength: 1530nm-1565nm, ITU-T DWDM 100 GHz C-band or custom
- Very low phase and frequency noise
- Very narrow linewidth, long coherence length
- Ultra-low RIN
- Excellent SMSR
- Unmatched wavelength stability over life and temperature
- Wavelength tunability
- Direct FM modulation
- Low sensitivity to vibration and acoustic noise
- SMF and PM fiber connector options
- Compact size, low power consumption
- Easy to set-up and use
- Digital controller and firmware with USB interface
- 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

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Data Sheet July 2020



Description

The ORION[™] laser sources are compact benchtop lasers based on 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[™] laser source's features provide end users with a stable, self-contained, easy-to-use alternative to complicated and expensive fiber laser sources.

The ORION[™] laser source 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 employed via a standard USB interface, using RIO-supplied software. The ORION[™] laser source is an ideal source for R&D, commercial, and advanced fiber optic sensing applications, such as interferometric and Brillouin DTSS systems for oil & gas, security and smart infrastructure 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, shorten product lifetime, and invalidates the device warranty.

Parameter	Min	Max	Unit
Storage temperature	- 40	+ 85	°C
Laser source supply voltage		5.5	V
ESD-susceptibility		500	V

Optical and Electrical Specifications

At recommended TEC set temperature Ts and bias current I_b

Parameter	Symbol	Condition	Min	Тур	Max	Unit	
Output Optical Power	Pout	CW	See or	dering infori	mation	mW	
		0 to +70 °C		±10			
Power Stability over case	dPout	+10 to +55 °C		±5		%	
temperature range		<u>≤</u> ±1 °C			±0.3		
Center Wavelength (ITU grid)	λ	± 40 pm standard ²	1530		1565	nm	
Wavelength tuning range ³	Δλτ	via TEC temperature change	30 ⁴			pm	
		0 to +70 °C		±10			
tomporature range 1	dλ	+10 to +55 °C		±5		pm	
temperature range		<u><</u> ±1 °C			±0.5		
Froquency stability 5	Vt1	Free running, over 1 hour		±2	± 4		
Frequency stability	Vt8	Free running, over 8 hours		±3	±6		
Pelative Intensity Noise	RIN	<u>></u> 1kHz			-140	dB/Hz	
		<u>></u> 500 kHz	Shot noise limited				
Side Mode Suppression Ratio	SMSR	CW, at specified Pout	40			dB	
Optical S/N Ratio	S/N	From spontaneous noise levels at +/-1 nm from λ	60			dB	
Polarization Extinction Ratio ⁶	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 build tolerance, 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. Tuning range is not symmetric around center wavelength, 30pm range is +10pm to -20pm as a minimum. Customized extended wavelength tuning range available upon request up to +/-45pm.

- 5. After 1 hour stabilization, tested with heterodyning of two lasers at constant case temperature.
- 6. With PM-fiber PANDA option. See ordering information page.

Modulation Specifications: Low Frequency [LF] (for both option RIO31XX- & RIO33XX-)

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Parameter	Symbol	Condition	Min	Тур	Max	Unit
Frequency modulation bandwidth ¹	f _{mL}	Sinusoidal modulation	DC		100	kHz
Frequency tuning efficiency ^{1, 2}	η _{mL}	Sinusoidal modulation at 10 kHz	25 ³	50		MHz/V
Tuning voltage magnitude ¹	VtuneL	Through BNC input	-4		+4	V
Output power modulation index ^{1, 4}	ML	Sinusoidal modulation at 10 kHz; wavelength tuning 100 MHz p-p		5	10 ⁵	%

1. Via pin4 of ORION D-9 connector

2. Tuning efficiency will vary over modulation bandwidth. Contact RIO for more information.

3. If this modulation feature is ordered with a grade 4 or grade 5 phase noise spec, this min spec value decreases to 20 MHz/V.

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- 4. Frequency modulation will lead to modulation of output power.
- 5. If this modulation feature is ordered with a grade 4 or grade 5 phase noise spec, this max spec value increases to 15%.

Parameter	Symbol	Condition	Min	Тур	Max	Unit				
Frequency modulation bandwidth ¹	fmH	Sinusoidal modulation, AC coupled	0.01	100	200	MHz				
		Sinusoidal modulation at 20 kHz	100	200						
Frequency tuning efficiency ^{1, 2}	n _{mH}	Sinusoidal modulation at 500 kHz	25	50		MHz/V				
		Sinusoidal modulation at 20 – 200 MHz	50	100						
Tuning voltage magnitude ¹	VtuneH	AC coupled, though SMC input			1	V _{p-p}				
Output power modulation index ^{1, 3}	M _H	Sinusoidal modulation at 100 MHz; wavelength tuning 100 MHz			4	%				

Modulation Specifications: High Frequency [HF] (for option RIO33XX- only)

1. Via 50 Ω , SMC connector

2. Tuning efficiency will vary over modulation bandwidth. Contact RIO for more information.

3. Frequency modulation will lead to modulation of output power.

Linewidth and Phase Noise Specifications

At recommended TEC set temperature Ts and bias current $\mathsf{I}_{\mathsf{b},}$

Parameter	Symbol	Conditions	Grade 1	Grade 3	Grade 4	Grade 5 ³	Unit
Spectral Linewidth, FWHM ¹	$\Delta\lambda$ L		<u><</u> 15	<u><</u> 5	<u><</u> 2	<u><</u> 1	kHz
Phase Noise		@ 10 Hz	123	41	20	10	μrad/rt-Hz
Typical Values ²	Phin	@ 200 Hz	22	8	4	2	1 m OPD

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	Тур	Max	Unit
Operating temperature range (ambient)	Tc		+15		+ 50	°C
Power Consumption	Pd	Over operating temperature range			4	W
Total current	I _{max}	Over operating temperature range			1.0	А

Front Panel Connectors

#	Description
F-1	FC/APC bulkhead connector with dust cap
F-2	BNC female connector for LF frequency modulation (option)
F-3	SMC female connector for HF frequency modulation (option)

Back Panel Connectors

#	Description
B-1	5V DC adaptor for power supply
B-2	Interface USB type B connector for external monitoring and control.



Mechanical Diagram





Optional SMC connector



Dim	Units	
L	227	
W	129	mm
Н	55	

Reliability and Certifications

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

Ordering Information



* Grade 5: 10 mW output power version only

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Accessories Included

- 5V DC power supply
- GUI software and operational manual
- USB cable
- SMC to SMA cable (for PN RIO33XX- only)

ITU channel	ITU Frequency TH7	Wavelength	ITU channel	ITU Frequency TH7	Wavelength	ITU channel	ITU Frequency TH ₇	Wavelength
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

DWDM ITU Wavelength¹

1. Standard wavelength build tolerance is +/-40pm. Custom build tolerance as tight as +/-5pm available upon request.

Laser Safety Information

The ORION laser module is classified as FDA/CDRH Class IIIb laser products per CDRH, 21 CFR 1040 laser safety requirements, and complies as Class 3R laser product per international standard IEC 60825-1, 2014.



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