



PART NUMBER 0405L-41A  
 ITEM NAME 405 NM SLM LASER

## PRODUCT DATASHEET



### DESCRIPTION

405 nm single longitudinal mode (SLM) diode laser, purpose-built for the demanding realm of quantum cryptography. Its exceptional coherence and minimal linewidth make it a vital tool for the application. Its applications extend to quantum key distribution systems, quantum encryption networks, and quantum communication protocols, all of which rely on its precision and stability to safeguard sensitive data against potential threats. These features make it an ideal choice for quantum key distribution and secure data transmission in quantum encryption systems, ensuring the utmost data security in a straightforward and practical manner.

This model could also be used in compact Raman spectrometers or fluorescence microscopes. Small footprint and +5 VDC operating voltage is exactly what's needed for handheld portable devices. Integrated precision driver electronics ensure low-noise and stable operation throughout the wide temperature range.

This free-space laser can be supplied with an integrated clean-up filter.

#### Note:

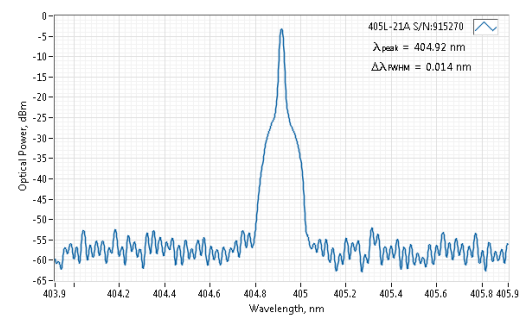
Back-reflections to the laser can cause spectral widening or even a COD (Catastrophic Optical Damage) of laser diode facet. In optical systems with significant back-reflections (e.g. more than 0.5%), the laser must be protected by using an optical isolator with at least 20 dB isolation. Typical applications include interferometry, confocal microscopy (especially working with reflective samples), etc. Failure to comply with these requirements will render the warranty void.

## SPECIFICATIONS

Specifications updated: 6 August 2024

Parameter	Minimum Value	Typical Value	Maximum Value
Central wavelength, nm	404.5	405	405.4
Spectral line width FWHM, MHz	-	20 <sup>1</sup>	60
Output power, mW	-	100 <sup>2</sup>	-
Power stability, % (RMS, 8 hrs)	0.02	0.05 <sup>3</sup>	0.2
Power stability, % (peak-to-peak, 8 hrs)	0.1	0.3 <sup>4</sup>	1
Intensity noise, % (RMS, 20 Hz to 20 MHz)	0.1	0.2 <sup>5</sup>	0.6
Side-mode suppression ratio (SMSR), dB	40	50	60
Longitudinal modes	-	Single	-
Transversal modes	-	TEM <sub>00</sub>	-
Beam width (1/e <sup>2</sup> ), mm	-	0.9 <sup>6</sup>	1.4
Beam height (1/e <sup>2</sup> ), mm	-	1.3	1.7
Horizontal beam divergence, mrad	-	0.9	1.5
Vertical beam divergence, mrad	-	0.5	1
M <sup>2</sup> horizontal axis	-	1.2	1.4
M <sup>2</sup> vertical axis	-	1.3 <sup>7</sup>	2.0
M <sup>2</sup> effective	-	1.3	1.6
Polarization direction	-	Horizontal <sup>8</sup>	-
Polarization contrast	1000	2000	-
Control interface type	-	UART <sup>9</sup>	-

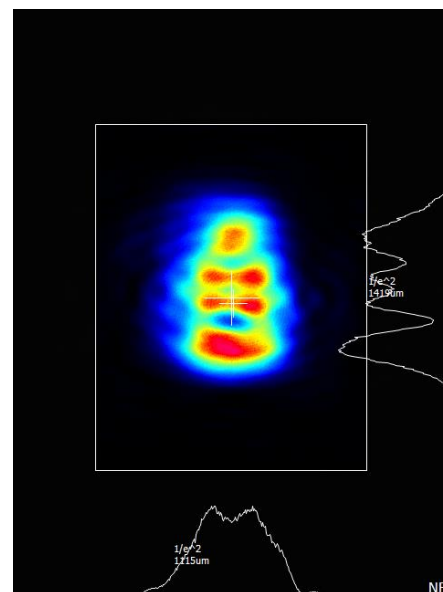
## TYPICAL SPECTRUM



Typical spectrum of 0405 nm diode laser. Measured with 10 pm resolution.

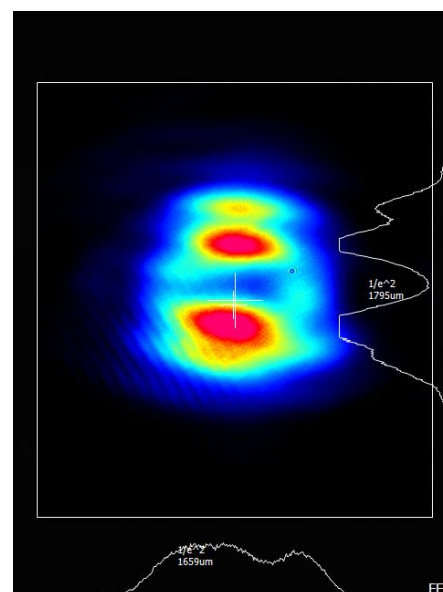
Operation mode	-	APC (CW) <sup>10</sup>	-
Modulation bandwidth, MHz	-	N/A <sup>11</sup>	-
Input voltage, VDC	4.8	5	5.3
Input current, A	-	1.5	-
Max. power consumption, W	0.4	2	10
Heat-sinking requirement, °C/W	-	1	-
Optimum heatsink temperature, °C	18	25	32
Warm up time, mins (cold start)	0.2	1	2
Temperature stabilization	-	Internal TEC	-
External fan control	-	Yes	-
Overheat protection	-	Yes	-
Storage temperature, °C (non-condensing)	-10	-	50
Beam height from the base, mm	9.9	10.4	10.9
Dimensions (WxDxH), mm	-	50 x 30 x 18 <sup>12</sup>	-
Net weight, kg	0.1	0.12	0.14
Laser safety class	-	3B	-
RoHS	-	Yes	-
CE compliance	-	- General Product Safety Directive (GPSD) 2001/95/EC - (EMC) Directive 2004/108/EC	-
OEM lasers are not compliant with	-	IEC60825-1:2014 (compliant using additional accessories)	-
Warranty, months (op. hrs)	-	14 (10000) <sup>13</sup>	-
Country of origin	-	Lithuania	-
Spectral line width FWHM, pm	-	0.01 <sup>14</sup>	0.03

## TYPICAL NEAR FIELD



Typical near field (0.45 m from output aperture) beam profile. Non-circularized beam of a 0405 nm direct diode laser.

## TYPICAL FAR FIELD



Typical far field (1 m from output aperture) beam profile. Non-circularized beam of a 0405 nm direct diode laser.

<sup>1</sup> Measured with a scanning Fabry-Perot interferometer having 7.5 MHz resolution, with scanning frequency of about 10 Hz. Interferometer testing is not provided for each laser being manufactured, the standard test is OSA measurement with 20-30 pm resolution instead.

<sup>2</sup> The output power of SLM lasers shall not be tuned and SLM performance is not guaranteed at power ratings other than factory preset. However, the power setting capability is not disabled. External attenuators are recommended instead.

<sup>3</sup> The long term power test is carried out at constant laser body temperature (+/-0.1 °C) using an optical power meter with an input bandwidth of 10 Hz. The actual measurement rate has a period of about 20 seconds to 1 minute.

<sup>4</sup> The long term power test is carried out at constant laser body temperature (+/-0.1 °C) using an optical power meter with an input bandwidth of 10 Hz. The actual measurement rate has a period of about 20 seconds to 1 minute.

<sup>5</sup> Noise level is measured with a fast photodiode connected to an oscilloscope. The overall system bandwidth is from 2 kHz to 20 MHz.

<sup>6</sup> Beam width and height are measured at 0.4 m from output aperture.

<sup>7</sup> The beam of this laser usually contains small artifacts, which make the  $M^2_y$  measurement worse. The beam quality improvement on Y-axis (vertical) is possible by sacrificing some output power (up to 30% loss of power). However, in applications where SM fiber coupling is needed, even at  $M^2_y = 2.0$  we guarantee that 50% of radiation will be coupled into the fiber.

<sup>8</sup> For lasers without integrated optical isolators.

<sup>9</sup> Break-out-boxes AM-C8 and AM-C3 can be used for conversion of UART communication to either USB or RS232.

<sup>10</sup> APC - Automatic Power Control.

<sup>11</sup> SLM lasers shall not be modulated - use external modulators instead.

<sup>12</sup> Excluding control interface pins and an output window/fiber assembly.

<sup>13</sup> Whichever occurs first. The laser has an integrated operational hours counter.

<sup>14</sup> Converted from bandwidth value.

Note: Product specifications are subject to change without prior notice to improve

## DRAWING

Drawing of 405 nm SLM Laser

reliability, function or design or otherwise.