Novanta

How to Read a CO_2 Laser Datasheet

This guide helps interpret technical specifications used in Novanta CO_2 laser datasheets. For more information, a Novanta Photonics Sales Manager or Applications Engineer can help specify the right CO_2 laser for your specific application.

Specification	What It Means	Why It Matters
Laser Type (Continuous Wave or Pulsed)	• **Continuous Wave (CW) Lasers** can produce a continuous beam of light. • **Pulsed Lasers** produce a series of high peak power pulses.	• **CW Lasers** are useful for marking, engraving, and creating smooth cuts in materials like acrylic. • **Pulsed Lasers** produce high peak power, which can improve cut edge quality, efficiently drill or perforate thin materials, and provide high power density to pierce challenging materials like metals.
Wavelength (9.3 µm, 10.2 µm, or 10.6 µm)	• Wavelength refers to the wavelength of light produced by the laser. • Lasers emit monochromatic (single wavelength) light. 9.3 µm, 10.2 µm, and 10.6 µm wavelengths are most common for CO_2 lasers.	• If a material has higher absorption of a given **wavelength**, processing is faster and the results are higher quality. Laser wavelength should be matched to your material's absorption properties. • **9.3 µm:** helpful for materials like PET or Polyimide. • **10.2 µm:** Polypropylene (PP) absorbs this wavelength best. • **10.6 µm:** the most commonly used CO_2 wavelength.
Average Power (Measured in Watts)	• This is the measured output power of the laser averaged over one on/off cycle.	• Higher **average power** leads to faster processing speeds.
Peak Power (Pulsed Lasers only; measured in Watts)	• The maximum power output of a laser. Pulsed lasers are optimized to have peak power that is much higher than their average power. CW lasers have peak power roughly equal to their average power.	• Higher **peak power** delivers energy more efficiently, which can improve cut edge quality, perforate or drill thin materials more quickly, and provide sufficient power density to pierce challenging materials like metals.

Specification	What It Means	Why It Matters
Power Stability (± specified % of average power)	• A measure of how consistent a laser's power output is over time.	• Greater **power stability** leads to greater consistency in processing. Mark color, engraving depth, cut quality (etc.) will appear consistent over time.
Beam Quality (M^2 value, typically <1.2)	• A measurement of beam quality. An ideal beam would have an M^2 value of 1, which is a perfect Gaussian beam. • Also called Mode Quality or Beam Quality Factor.	• **M^2** indicates how well a beam can be focused to a small spot size. This increases power density for higher speed processing or greater detail.
Beam Diameter (Measured in mm)	• Measured diameter of the laser beam, defined as the full width where the intensity falls to $1/e^2$ times the maximum value.	• **Beam diameter** is useful for properly integrating the laser into a system. Additional optics can be added to the beam path to change the beam diameter.
Divergence (Measured in milliradians)	• An angular measurement indicating how quickly the beam diverges, or expands from its narrowest point.	• **Divergence** is useful for properly integrating the laser into a system. Additional optical components can be added to the beam path to change the divergence characteristics.
Ellipticity (Maximum ellipticity)	• Refers to beam symmetry; it is a measure of how round the focused spot is. • An ideal beam would have an ellipticity of 1, typical values are <1.2.	• A more circular beam produces the best application results, with consistent performance regardless of processing direction.
Polarization (Linear Orientation, Circular, Elliptical, or Randomly)	• Polarization describes the orientation of the electric field with respect to the direction the laser light is propagating.	• Certain materials can be sensitive to **polarization**, displaying different cut characteristics depending on the cut motion. • Polarization is also important for integrating optical isolators or beam splitters.
Rise/Fall Times (Maximum value in microseconds seconds)	•The amount of time required for the laser output to go from zero watts up to its maximum for a given duty cycle (rise time) and then return to zero (fall time).	• Faster **rise/fall times** ensure best results for high speed marking, engraving, perforating, or scribing. Faster times mean less wasted heat energy is delivered to the material, producing higher quality results at higher speeds.

Specification	What It Means	Why It Matters
Operating Frequency (Measured in kHz)	• This is the maximum frequency command that can control the laser (e.g.: how often the laser is being commanded to fire). The frequency for full optical depth of modulation for the pulses is lower, and is determined by rise/ fall times.	• Low frequencies (<10 kHz) can be useful for cutting challenging materials or perforating thin materials. • Higher frequencies (>10 kHz) allow laser pulses to merge together and are useful for marking or cutting.
Duty Cycle Range (A percentage of laser on time)	• Duty cycle is the percent of laser on time in a given command signal. (e.g.: 50% duty cycle means the laser is firing half the cycle time and off the other half). • CW lasers are assumed to have a duty cycle range up to 100%, or continuously on.	• Pulsed lasers are typically duty cycle limited, allowing them to achieve high peak power. A broader duty cycle range can allow greater processing flexibility, but the usefulness of this is application-dependent.
Maximum Pulse Length (Pulsed Lasers only; measured in μ-seconds)	• Maximum time a pulsed laser can be on.	• Similar to duty cycle range, longer pulse lengths can lead to greater processing flexibility, but its usefulness is application-dependent.

Additional specifications should be considered, including:

• **DC Input Voltage:** consistent input voltages across a series of lasers allows for an easy upgrade path in the future if higher throughput is needed. It also allows easier integration with scan heads of the same voltage.

• **Maximum Chassis Temperature or Operating Ambient Temperature:** higher values in these categories ensure lasers are robust and can operate in challenging environmental conditions.

• **Form Factor** (length, width, height, weight): this may be important depending on how the laser will be used or integrated into a system.

Interested in speaking to one of our knowledgeable representatives?

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