

Overview of Superpulsed CO₂ Lasers.

RF Driven CO₂ lasers are typically designed to operate in a pulsed mode, at a specified Peak-Power. The pulses can vary in duration from near zero to continuous-wave (CW) - the laser is on continuously. Further, at the time of shipping, a laser could produce a significantly more peak-power than specified. This additional, or reserve power is common in CO₂ lasers, and is intended to further the specified lifetime of a laser that is known to have power degradation over time; the laser will stay within specification longer.

To vary the power of a typical CO₂ laser it is Pulse-Width-Modulated (PWM), or turned on-and-off in a ratio-metric manner, "duty-cycle", where the on-time percentage is approximately the percentage of peak-power that will be seen at the lasers output. The predefined modulation frequency is the fundamental for PWM. Therefore a typical CO₂ laser operating under the CW threshold is a Pulsed laser.

Superpulsing a CO₂ laser is a technique to achieve higher than CW peak-powers. This done by exciting the lasers cavity with substantially more RF electrical energy and in-turn creating substantially more optical power. Superpulsing has a significant benefit in certain applications where a large slug of optical energy is needed to punch through a material surface and begin the process of cutting or welding. Another benefit of Superpulsing is that the large and fast slug of optical energy will typically limit the thermal damage, or charring, to the surrounding material.

Superpulsing is not achieved without a compromise that limits the duty-cycle of laser operation to typically less than 50%. So for example a Superpulsed 100W laser might be specified to have a peak power of 250W, but for a duty-cycle of 40% maximum. The limit on duty-cycle is to prevent the laser's CO₂ gas from becoming overheated and creating thermal conditions that will degrade other laser performance parameters, and could ultimately destroy the laser.

Iradion Laser, Inc.
51 Industrial Drive
N. Smithfield, RI 02896 USA
+1 401 762-5100