LightMachinery
Excellence in Lasers and Optics

IMPACT®-4000 SERIES

High Energy, Ultra-Short Pulse TEA CO_2 Lasers

A range of standard ultra-short pulse TEA CO_2 lasers
for advanced applications in science and industry

- Based on LightMachinery's industry-proven IMPACT-2000 Series
- Repetition Rates to 150 pps, Pulse Energies from 400 mJ to 5 Joules
- Ultra-short pulse (~100 ns) operation available as a standard option
- Multi-module oscillators and oscillator-amplifier MOPA) systems available as standard options.
- Line-tuning and Single-mode (TEM_{oo} / SLM) operation available as standard options

Typical Applications

- Non-Destructive Testing / Laser Ultrasound
- Laser Photochemistry / Isotope Studies
- Plasma Diagnostics
- Optical Damage Studies
- Laser Propulsion and Particle Acceleration
- Material Ablation & Surface Removal

The **IMPACT-4000 Series** lasers are based on LightMachinery's industrially-proven IMPACT-2000 TEA CO_2 lasers, modified to allow more versatile operation including short duration pulses, wavelength tuning and mode control, as is required in many scientific and some industrial applications.

Three models offer energies from 400 mJ to 5 Joules and repetition rates from 12 Hz to 150 Hz. Standard options available with IMPACT-4000 Series lasers include:

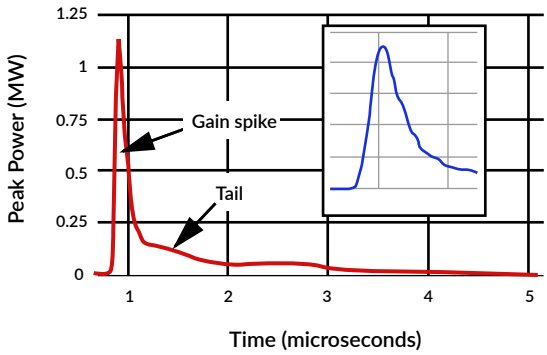
- Wavelength tuning over the full range of CO_2 laser lines
- Single transverse-mode (TEM_{00}) operation
- Single longitudinal-mode (SLM) operation
- Multi-Module and MOPA configurations

IMPACT-4000 Series lasers can be supplied in a range of standard multi-module oscillators and master-oscillator / power-amplifier (MOPA) configurations. The beam parameters (divergence, line width, mode structure, range of wavelength tuning, etc.) are mainly defined by the Master Oscillator, and the final energy is determined by the number and configuration of Power Amplifier modules.

Pulse Duration and Shape

The pulse shape of TEA CO_2 lasers typically consists of a short (~100 ns) pulse (the "gain spike") followed by a longer tail. The maximum peak power of the laser is determined by the energy and duration of the "gain spike". The pulse shape, peak power and energy distribution between the gain spike and the tail of TEA CO_2 lasers can be tailored to individual requirements by selecting the appropriate gas mix and other laser parameters. IMPACT-4000 lasers have been characterised in "standard pulse" and "short pulse" operation. An example of the pulse shape of an Impact-4150 laser operating in short-pulse configuration is shown at the right.

Impact-4150 Laser: Example of pulse shape and peak power in a typical short-pulse configuration



Specification

Model Number:	Unit	4012	4015	4150
Repetition Rate (Pulses per second, Maximum)	Hz / pps	12	15	150
Pulse Energy (Total, standard pulse operation)	Joules	5.0	4.0	0.4
Average Power (Standard pulse operation)	Watts	60	60	60
Pulse Energy (Total, short pulse operation)*	Joules	3.5	2.5	0.25
Gain Spike Duration (Short pulse operation, FWHM)*	ns	100	100	100
Peak Power (Short pulse operation in gain spike)*	MW	12	10	1.0
Beam Size (multimode, at laser, V x H, FWHM, nominal)	mm	25 x 25	25 x 25	14 x 11

Specifications apply in multimode configuration and at 10.6 µm wavelength.

The specified performance is typical but can be adjusted to suit individual customer requirements. Not all specifications may be obtained simultaneously. The use of CO2-rich gas mixes for short-pulse operation requires the addition of an internal catalyst (part number AC-5972). Please consult LightMachinery regarding the optimum configuration for your preferred performance.

A Wide Range of Standard Options

Options available for the Impact-4000 Series lasers include:

- **Line Tuning**– allows the laser to be tuned to many of the CO2 lines between 9.2 and 10.8 µm
- **Single Transverse Mode**– a variable internal aperture allows selection of transverse modes including TEMoo
- **Single Longitudinal Mode**– an intra-cavity low-pressure cell, with TEMoo aperture, ensures SLM operation
- **Multi-Module Configurations**– for specialised applications, Impact-4000 modules can be combined in multi-module oscillators or in oscillator-amplifier (MOPA) configurations

For further technical and sales information, please visit our website or contact:

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