

Standard Operating Procedure

Lumonics TEA-203 Tunable CO₂ Laser

December 3, 2008

Generated by D. Turnbull

Version 1.0 first draft for review purposes only.



Glow discharge from the laser tube when viewed from above with the cover removed (courtesy of J. Brown).

Background Information:

Laser: Lumonics TEA203 (transversely excited atmospheric) tunable CO₂ Laser.

Location: Niagara College, Welland campus, V15 laser lab.

Power Output: Current operational condition = 0.5 to 4 J/pulse
tunable 9-11 μm .

Power levels indicated on laser cover: Output = 30J Duration =
0.05 to 0.5 μs , Wavelength 9-11 μm .

Power levels found in literature: Output 15J, Duration = 170
ns (FWHM), wavelength = 10.6 μm

Laser can be operated as a single shot or with pulse rates up to 1 Hz.

Gas Mix: Praxair Specialty Gases & Equipment, LaserMark V,
Part Number - LS MARK5-T.

Safety:

1. This laser is a Class IV laser and operators are expected to be familiar with proper safety precautions before operating this laser. The operator is directed to the Standard, ANSI Z136.1 (2000) *Safe Use of Lasers*.
2. **Eyewear must be worn at all times** that protects the operator and anyone else in the nominal hazard zone against radiation 9 to 11 μm region with an optical density of at least 7.
3. Laser operates at extremely high voltages, capable of > 30,000 volts. Operation with the cover removed and interlocks defeated is only to be done by qualified personnel.

Precautions:

1. This SOP has been written for operation within a very specific operating range (15 to 30" Hg fill pressure). Operation outside of these parameters can cause arcing between the electrodes causing damage to the laser.
2. The spark gap pressure is set for the operating range given in this SOP (15 to 30" Hg fill pressure). There is a chance of the spark gap discharging and firing the laser without the fire button being pressed if operated outside this range. The spark gap would have to be recalibrated for operation in other pressure ranges.

Operation:

1. Turn on the exhaust for the vacuum pump (located beside transformers by door of V15 lab). Make sure the pump exhaust hose is in the exhaust manifold.
2. Make sure a beam dump is in front of laser, laser safety glasses are on, the laser warning light above door is on, and the CO₂ TEA laser door sign is indicated with laser on sign.
3. Turn on vacuum pump.
4. Open valve between laser and vacuum pump. Vacuum should increase from ~0" Hg to >30" Hg.
5. Open Valve for compressed air. Confirm regulator is set to 1-bar and flow to 0.3 SCFH.
6. Connect multimeter to controller box (20V DC range), ensure the laser power dial on the control box is at zero (fully counter clockwise).

7. Turn on power to laser (power main toggle switch on rear of laser. Leave solenoid toggle switch if the off position). Allow a few minutes for the power supply to warm-up.
8. Fill the tube with the Mark V gas mix (open flow valve at the gas cylinder 1 full turn, set regulator pressure to ~2 psi). Close the vacuum valve then open the needle valve on the regulator until the desired pressure is reached (operating range is 15 to 30" Hg). Close both the needle valve and the main cylinder valve on the tank once the tube is filled.
9. Obtain key for laser and insert into controller box
10. Turn the key to the ON position. The multimeter should read ~2.5V. Adjust potentiometer until required voltage is needed (see calibration charts – note 4.0VDC is about the minimum threshold for lasing). Refer to calibration sheet to get the corresponding high voltage value for the meter reading.
11. Turn on power to the trigger module. Pressing the trigger button on the trigger module will fire the laser in a single shot.

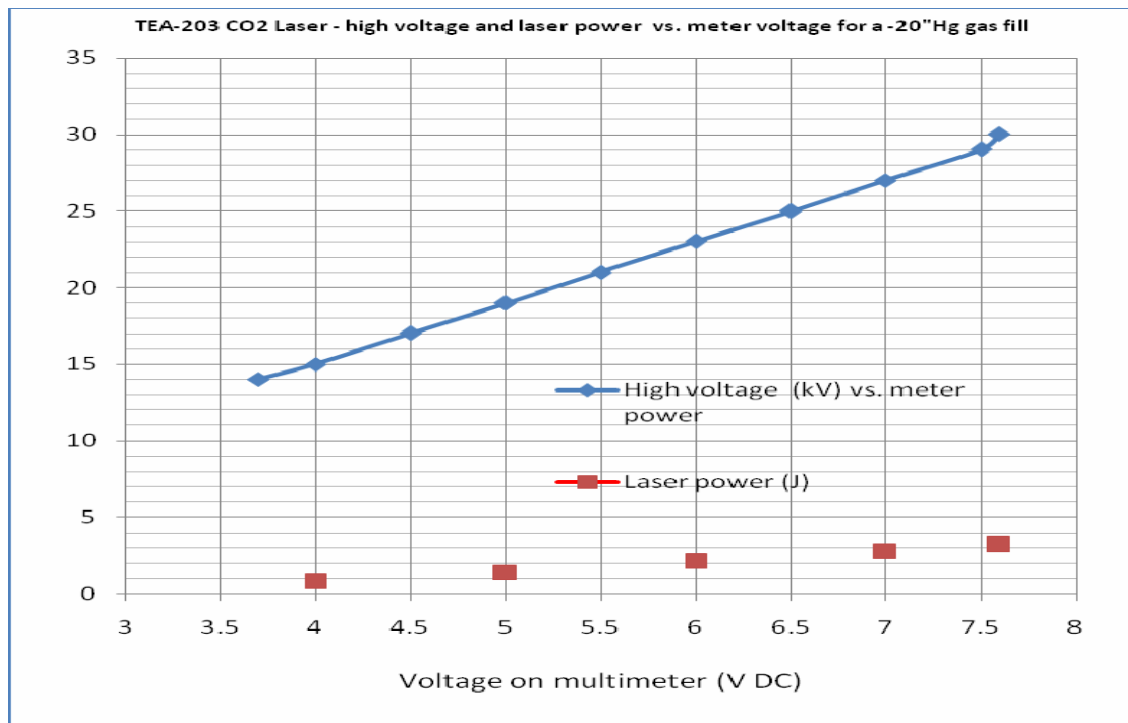
Laser can be fired to a maximum rate of 1 Hz. using a function generator connected to the trigger module (note if function generator is too close to the laser noise will cause function generator to reset when trigger button is pressed). The Agilent 33120A generator must be set to: 1 Hz or less, 0square wave, 5Vpp, +2.4VDC offset. If generator is set-up on TEA laser these values are saved and can be recalled by pressing recall 1 then enter.

Shutdown:

1. Turn the key to the off position and remove.
2. Turn the voltage down to minimum (fully counterclockwise).
3. Turn multimeter off.
4. Turn trigger module off (and function generator if used).
5. Turn main valve for compressed air off.
6. Fill tube to 0" Hg with gas mix. As described in step 8 above.
7. Make sure gas cylinder flow, needle, and main valves are off.
8. Turn off Vacuum pump and exhaust.

9. Turn off power supply main switch (make sure several minutes cool down time has passed).
10. Complete log book and return key.

Power Calibration:



Calibration from December 3, 2008