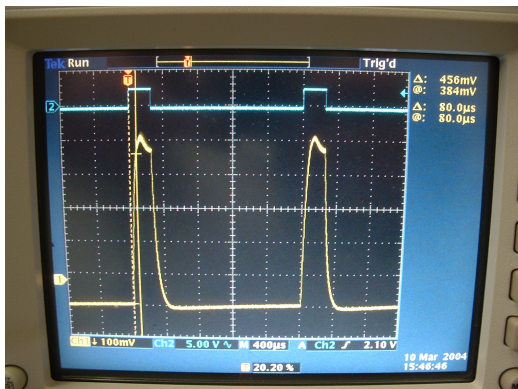


Application Note: Super Pulse Operation

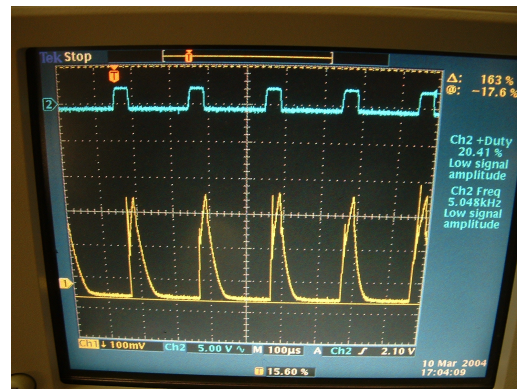
When the laser is driven three times harder for a short period of time its output can be three times higher than its normal CW (Continuous Wave) power. **This mode of operation is called SUPER PULSE.** It provides a higher energy laser in a smaller package without the extra cost. In laser applications such as surgery, marking on glass and ceramic, and cutting thin metal foil it was found that the jolt of a high energy pulse vaporizes the material more quickly and leaves less charring, cracking, burning and debris. In surgery it makes the procedure more effective and less painful.

Optimizing the Pulse Parameters for Super Pulse Operation

Typically in CO₂ lasers the optical response is slower than the electronic control signal. The laser power will not rise instantaneously to its peak when the **on** command is issued, nor will it drop to zero immediately with the **off** command, as can be seen on the scope traces below. Therefore it is the best to allow the laser pulse to be somewhat longer than the rise time, typically around 100 μ s to achieve high pulse energy. Super pulse is best when used at fixed frequency and pulse length.



A) 240 μ s pulses at 500 Hz



B) 40 μ s pulses at 5 kHz

In waveforms A and B the upper blue trace is the command signal and the lower yellow trace is the laser pulse train. The longer pulse on the left has enough time to achieve its peak power, but it is at a low frequency. Although the shorter pulse on the right does not achieve the highest possible peak power it is very useful in many applications where a fast pulse train is required.

There are many trade-offs in pulse shape and pulse energy during the manufacturing of a laser. Access Laser Company can customize its products to optimize the laser pulse parameters for a particular application.

How to Vary Pulse width and Frequency

For all the Access Laser products there is a BNC port on the RF driver where the customer can supply his/her own pulse signal at a wide range of frequencies and pulse lengths. A general purpose pulse generator or function generator can be used to supply this variable signal. 0 volt will turn off the laser and 5 volts will turn on the laser. Laser controllers from Access Laser provide a knob for pulse width control at a fixed frequency, 2.5 kHz, 5 kHz or 15 kHz. (Please consult the user's manual or the factory for correct information on your specific laser.)

For a super pulse laser the pulse length is typically limited to 400 μ s, and the duty cycle to 30%. A super pulse laser will not operate in the CW mode. Its average power is typically lower than its CW counterpart. For these reasons some applications that require high average power rather than high energy pulses will not benefit from this mode of operation.