



Pulse Quench

Lee Laser First-pulse Suppression

“Giant Pulse”

Some users of Q-switched CW Nd:YAG lasers have noticed that the first pulse in a string of pulses contains a much greater energy level than those that follow. This usually becomes evident in certain industrial applications such as resistor trimming or laser engraving, and is characterized by a small crater at the beginning of each cut or scribe line segment.

This “giant pulse” can cause a variety of detrimental manufacturing process problems from unsightly laser engraving to poor tolerance control on laser trimmed microcircuits. It also can cause premature failure of some optical components such as harmonic generators that are sensitive to excessive pulse power.

First-Pulse Suppression (FPS) of Q-switched Pulses

The Lee Laser Q-switch Driver contains special circuitry that is designed to suppress this first, “giant pulse” so that its energy content is less than that of successive pulses. The BNC connector labeled **FPS** on the rear panel of the Q-switch Driver (ref. Lee Laser Drawing Nos. 130089 or 130093) provides computer access to enable the FPS function.

The **FPS** BNC connector serves two functions:

1. For control of individual laser pulses:

For users that wish to control the emission of each laser pulse through **EXT. FIXED** BNC, the computer must send a 5-vdc modulation control pulse to initiate each Q-switched laser pulse. A separate signal must be sent to the **FPS** BNC at a time interval of 40-100 μ s *prior* to the first modulation control pulse to initiate suppression of the first “giant pulse.” This requires a 5-vdc “trigger” pulse that is separate from the modulation pulse. Drawing No. 130092 illustrates the timing for FPS and modulation control pulses.

As an alternative, a “T” BNC connector may be attached to the **EXT. FIXED** BNC with a connection also to the **FPS** BNC to automatically initiate first pulse suppression.

In this case, emission of the first full-amplitude pulse will be delayed by 40-100 μ s, during which time the first “giant pulse” that precedes it will be suppressed. In cases where the fast retriggering RF Control P.C.B., (p/n 020071-002), is installed in the Q. Switch Driver assembly the **EXT. FIXED** BNC can’t be paralled with the **FPS** BNC to automatically initiate First-Pulse Suppression. In such cases it is necessary to provide a separate 5-vdc signal to the **FPS** BNC at a time interval of 40-100 us prior to the first modulation control pulse to the **EXT. FIXED** BNC to initiate suppression of the first pulse.

2. For “gate” control of a series of pulses

Users that wish simply to control series of Q-switched pulses may input a 5-vdc signal into the **FPS** BNC to initiate the series of pulses. The pulse frequency will be determined by the frequency adjust (**FREQ ADJ.**) control knob on the front panel of the Q-switch driver. Q-switched pulses will be emitted from the laser as long as the 5-vdc signal is present on the **FPS** BNC connector. The first pulse of each series of pulses automatically will be suppressed.

“Giant-Pulse” Suppression During Gated CW Operation

FPS also is useable in gated CW operation (the Q-switch as a high-speed shutter). In this case, the modulation control signal, 5-vdc, is connected to the **EXT. VAR.** BNC. The laser will emit a continuous (CW) beam for as long as the 5-vdc signal is present on the **EXT. VAR.** BNC. A “T” BNC connector may be attached to the **EXT. VAR.** BNC with a connection also to the **FPS** BNC to automatically initiate suppression of a “giant pulse” that will precede the CW beam. In this case, emission of the CW beam will be delayed by 40-100 μ s, during which time the “giant pulse” is suppressed. As previously mentioned, cases where the fast retriggering RF Control P.C.B., (p/n 020071-002), is installed in the Q. Switch Driver assembly the **EXT. VAR.** BNC can’t be paralled with the **FPS** BNC to automatically initiate First-Pulse Suppression. In such cases it is necessary to provide a separate 5-vdc signal to the **FPS** BNC at a time interval of 40-100 us prior to the first modulation control signal to the **EXT. VAR.** BNC to initiate suppression of a “giant pulse” that will precede the CW beam.