TECHNICAL NOTE

# LDP-3830 LASER PROTECTION

**The LDP-3830 Precision Pulsed Current Source is designed to drive laser diodes and quantum cascade lasers with up to 5A of peak current and a compliance voltage of 20V. Laser diodes and quantum cascade lasers are sensitive to electro-static discharge, excessive current levels, and current spikes, also known as transients. The LDP-3830, when utilized with the LPB-386 pulse board, has been designed with multiple levels of laser protection to minimize exposure to electro-static discharge, excessive current levels, and transients.**

## REDUNDANT CURRENT LIMITS

The LDP-3830 incorporates a firmware and hardware current limit. When a current limit is set via the front panel or remote interface the value is stored in non-volatile memory. The firmware will not allow the user to set the current set point to a value greater than the current limit. The firmware will also set the current limit on a digital to analog convertor that is fed into a comparator. The comparator compares the output of the LDP-3830 to the current limit set point and if the output is greater than the set point, the LDP-3830 will close the output shorting relay, disable the current source, and power down the power supply to the current source. Figure 1 provides a schematic overview of the current limit protection of the LDP-3830.

## OUTPUT SHORTING RELAY

Displayed in Figure 1, a normally closed mechanical shorting relay is placed across the device under test (DUT) to protect the laser diode during power up or power down. By shorting the output of the device, the leads are maintained at the same potential when the laser is not in operation. This feature is engaged even when the power of the LDP-3830 is off.

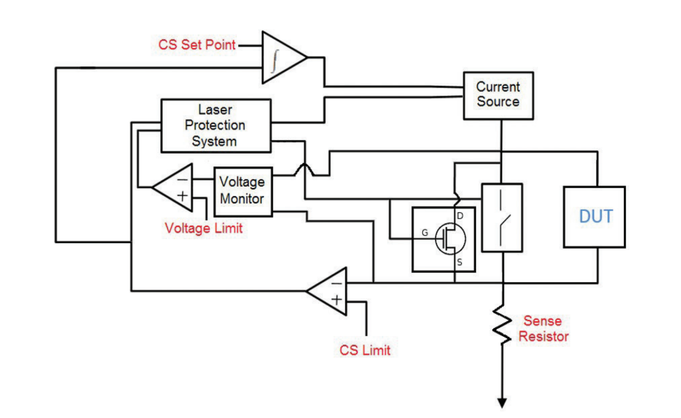


*Figure 1- Schematic diagram of the LDP-3830 laser protection system circuitry*

## SLOW START AND SAFE SHUT DOWN

When the LDP-3830 output is enabled, the laser current output is slowly ramped up to minimize any potential for current or voltage overshoot due to a large DUT impedance. Figure 2 shows a screen capture demonstrating the slow current ramp.

Figure 3 shows the fast shut down of the LDP-3830 either by the output being disabled or a safety interlock being tripped. The large current spike is only observed in the current monitor and not in the optical signal. The current spike is only present in the monitor because the shorting relay has been engaged across the DUT and the residual charge left in the capacitor bank is being drained across the sense resistor.

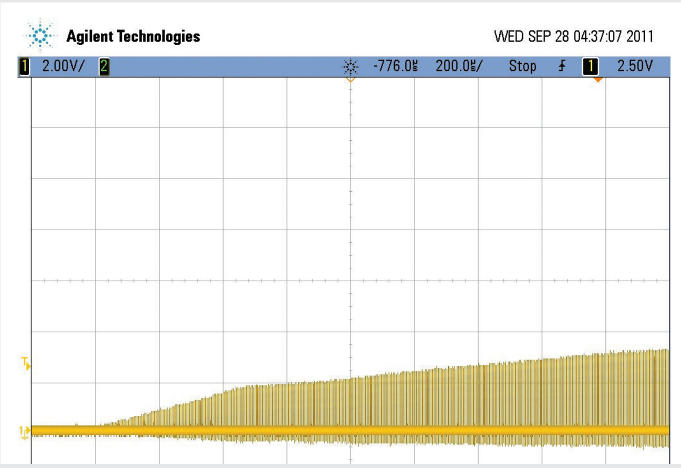


*Figure 2: LDP-3830 slow ramp to 2.5A.*

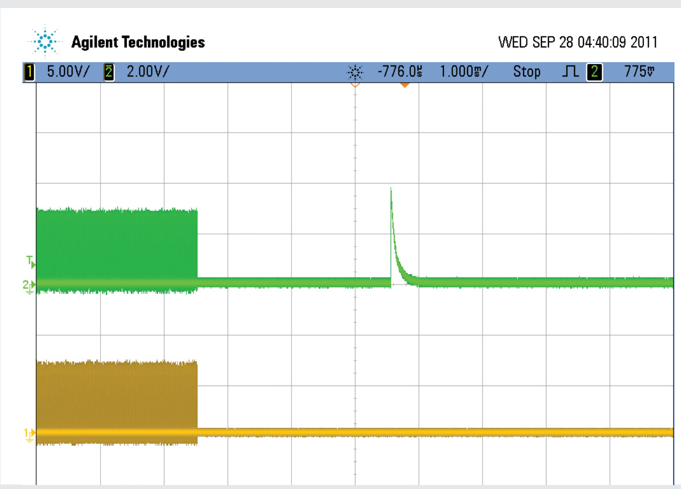


*Figure 3: The fast shut down response of the LDP-3830. The yellow signal is the optical output and the green signal shows the current monitor*

## SAFETY INTERLOCKS

The LDP-3830 has two interlocks that will safely disable the output if tripped. One interlock is designed to be compatible with ILX Lightwave's LDT-5948 and LDT-5980 Thermoelectric Temperature Controllers and uses a TTL high to signal if the instrument is within temperature tolerance or the output is enabled. The second interlock is a standard open to disable and close to enable that is designed to be used with other temperature controllers or a safety hood switch.

## TRANSIENT PROTECTION

Transients including operational and power line transients were tested by connecting a LDP-3830 to a high power fiber coupled laser diode. The output was measured by a reversed biased high speed photodetector; the photodiode signal was conditioned by a 10 µF capacitor in parallel with the sense resistor and photodiode. The sense resistor was connected to a Tektronix TDS 3054 oscilloscope. The setup has the ability to measure 2 ns transients.

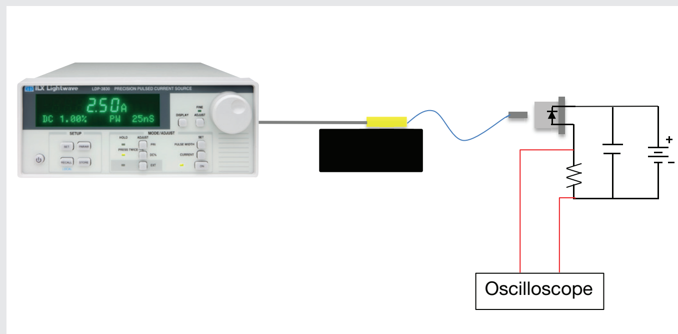


*Figure 4: Schematic diagram of transient testing of the LDP-3830.*

No transients were measured during normal operation. Figure 5 shows a loss of power/brown out condition transient. This shut off condition is identical to a normal output off shut down.

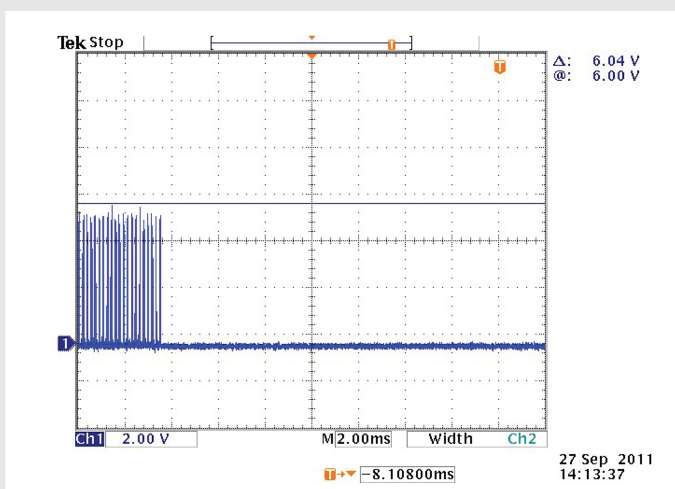


*Figure 5: Loss of power or brown out turn off.*

Figure 6 shows the transients during a 1kV electronic fast transient (EFT), the instrument quickly disabled the output with no overshoot. The screen capture was obtained by triggering off of the EFT burst by using an antenna placed close to the AC power cord. The noise observed at the end of the pulse train was caused by the EFT burst being coupled into the BNC cable connected between the optical measurement circuit and the oscilloscope.

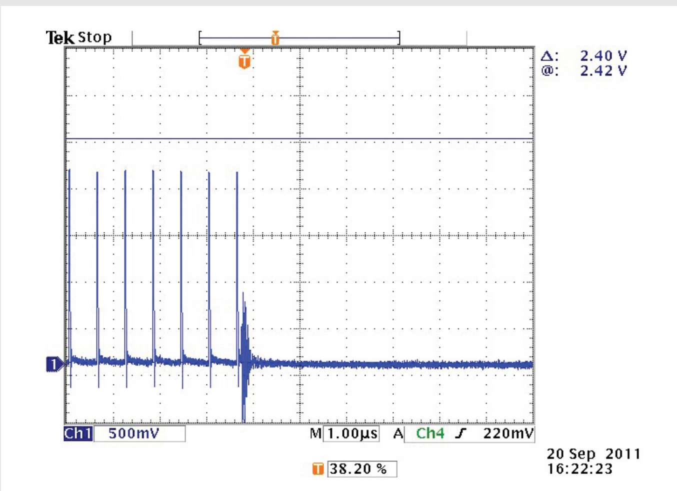


*Figure 6: Screen capture of 1kV EFT event on the AC power line.*

Figure 7 shows the transient during a 1kV surge, the instrument shut down the output with no overshoot. The 1kV surge did cause the instrument front panel to randomly illuminate the display and LEDs during the surge event, after the event the power was cycled and the instrument went back to normal operation.

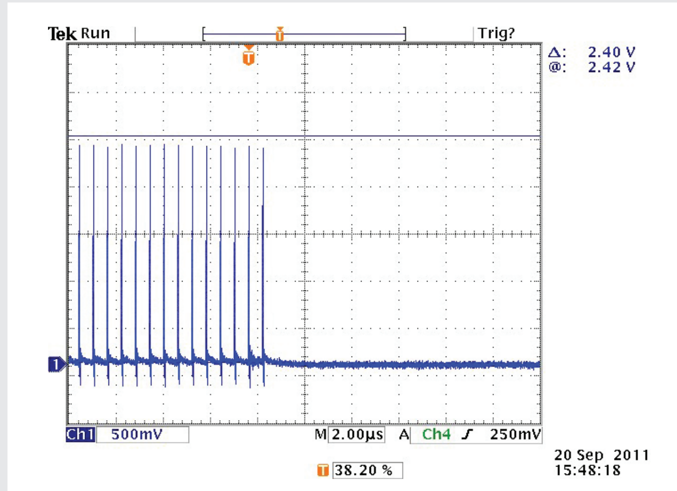


*Figure 7: Screen capture during a 1kV surge event on the AC power line.*

## CONCLUSIONS

The multiple levels of laser protection ensure the LDP-3830 will protect laser diodes and quantum cascade lasers during normal operation and under strenuous operation. Due to this attention to detail during the engineering design, our ILX LDP-3830 Precision Pulsed Current Source will provide industry leading device protection, lowering your cost of operation and minimizing down time in your research and design applications.

For additional information on safe operation of laser diodes and quantum cascade lasers, read ILX Lightwave Application Note #3 Protecting Your Laser Diode.

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