TECH NOTE

LDC-3700B Intermittent Contact Protection

OVERVIEW

The LDC-3700B series precision laser diode controller incorporates multiple industry leading protection features which have been developed by ILX Lightwave specifically for safely controlling laser diodes. These include slow start circuitry, a normally closed output shorting relay, adjustable current and voltage limits, and transient protection. Additionally, a fast all analog hardware feedback control loop shut-off circuit protects against over-voltage and over-current conditions which may occur due to brief open circuit conditions caused by poor cabling or fixture connections. These brief open circuit conditions are commonly referred to as intermittent contacts. The speed at which a laser diode current source detects an open circuit, and safely shuts the output off is critical to protecting the laser diode device under test. This Technical Note presents the results of measurements detailing the fast shut-off time of the LDC-3700B during an intermittent contact event. It should also be noted that the LDC-3700B offers a user programmable adjustable compliance voltage clamping protection feature. This Technical Note focuses solely on the fast feedback open circuit detection and shut-off protection circuitry.

BACKGROUND

Laser diodes are highly susceptible to damage if too much energy is supplied to the device under test. When electrical contact to the laser diode under test is briefly broken and re-established, many conventional DC power supplies and commercially available laser drivers are not optimized to respond immediately to the open circuit and short the output quickly enough to prevent damage when electrical contact is re-established. When the contact is re-established, all of the power available from the main power supply transformer can be discharged across the laser diode under test. The result can be catastrophic damage to the laser diode. To eliminate this potential damage condition, ILX Lightwave has developed a fast feedback all analog control loop which shorts the output quickly enough to prevent damage, and a user programmable adjustable compliance voltage limit.

MEASUREMENT SETUP

The measurement setup, as shown Figure 1, replicated a 100 ms intermittent contact condition. The setup consisted of an ILX Lightwave LDC-3724B precision laser diode controller, an Agilent 33120A function generator, a Tektronix TDS-3014 oscilloscope, and a Tektronix PS280 laboratory power supply. The function generator was set to burst mode and delivered a square wave pulse. This pulse activated an N channel MOSFET, causing the relay coil to become energized and yielding the brief intermittent contact condition. To highlight the fast shut-off control loop of the LDC-3724B, the adjustable compliance voltage limit was not set for this experiment.

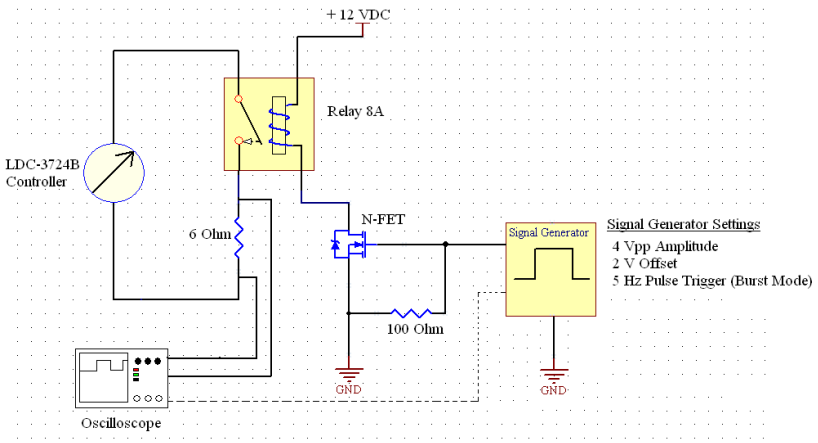

Figure 1: Measurement Setup

RESULTS

Figure 2 shows the control loop circuit's fast shut-off response of the LDC-3724B to a brief open circuit condition. A 100 ms single shot pulse, shown as channel 3 on the oscilloscope, was sent to the test circuit. The shut-off response of the LDC-3724B is shown on channel 2 of the oscilloscope. The LDC-3724B reliably detects the open circuit through the four-wire voltage sense feature and shuts-off the output within 200 µs, preventing damage to the laser diode.

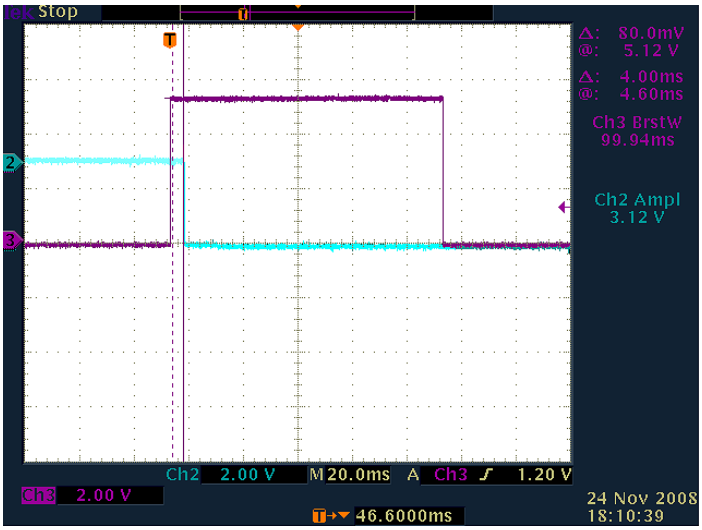

Figure 2: Open Circuit Response

CONCLUSION

This Technical Note demonstrates that the LDC-3700B series of laser diode controllers protects against dangerous over-voltage and over-current conditions resulting from poor cable connections or poor electrical connections at the laser diode device fixture location. An all analog fast open circuit detection and shut-down control loop is one of the many standard ILX Lightwave laser diode protection features.