TECH NOTE

LRS-9424B Transient Protection

OVERVIEW

Protection from harmful electrical transients is important in all applications of laser diodes due to the highly sensitive nature of these semiconductor devices. This is particularly true in life-test and burn-in applications where data integrity and production cost may be impacted. During life-test of laser diodes, thousands of hours of data are collected in order to calculate the life times of the devices. Any damage or loss of devices caused by the test system or an external power line transient can result in erroneous data or loss of thousands of hours of test time. During production burn-in, any loss of devices due to the burn-in test system reduces yield and increases the overall cost of test. Fortunately, with careful design it is possible to eliminate these risks.

The LRS-9424B Laser Reliability and Burn-In Test System, like all ILX Lightwave instruments, uses multiple levels of laser diode protection. A list of the laser diode protection features used in the LRS-9424B is provided below:

- Normally closed shorting relays protect lasers during power startup and power shutdown.
- Monitoring circuitry ensures that power systems have stabilized before current is supplied to the lasers.
- Turn-on protection of the laser diodes is accomplished by slowly ramping the laser diode current.
- AC power monitoring circuitry quickly shuts down lasers in the event of power failure.
- System is tested to ensure that operational and power line induced transients result in less than 10 mA surge at the laser diode.
- Fixtures are supplied with shorting clips which may be installed at the end connector to prevent static build up and inadvertent static discharge to circuit traces when the fixture is removed from the system.

This technical note focuses on the transient protection of the LRS-9424B during turn on, turn off, power failure, and instances of a surge in the power line. For turn on, turn off, and power failure it is expect that there will be no transients and for a surge on the power line no more then a 10 mA spike should be observed at any device under test in the system.

TEST SETUP

The test was conducted on an LRS-9424B Laser Reliability and Burn-In Test system with Toshiba TOLD9200 laser diodes and an LRS-9400-322B 200mA Control-Measure Module. To monitor for transients, a New Focus model 1801 high speed photo detector was coupled into a Lecroy LT344 oscilloscope to monitor the light from the Toshiba laser diodes. The Lecroy oscilloscope was configured to trigger on a falling or rising edge whichever was appropriate for the test. The New Focus detector and Lecroy oscilloscope can effectively measure a 3 ns rise time which was sufficient for measuring any transients in the LRS-9424B. A measurement transfer function of 136 mA/V was determined in order to analyze the results seen on the Lecroy oscilloscope. A Keytek CE Master was used to create the 1 kV power line surge.

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RESULTS

Slow Turn-On. The figure at right shows the slow start protection of the LRS-9424B. By slowly ramping the current, the laser diodes are protected against any initial transients that can be caused by turning on the output.

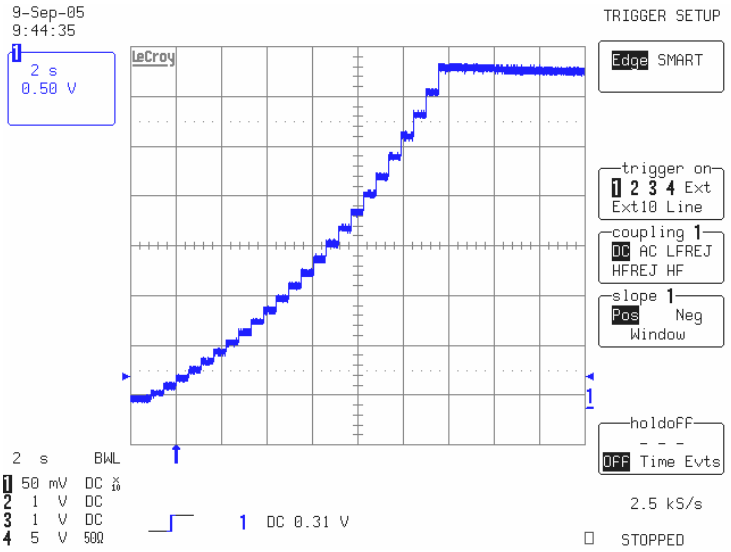

Figure 1

Fast Turn-Off. During power down of the laser diodes, a signal is sent from the control logic of the laser diode driver to adjust the current output set point to zero. After the output is set to zero, a "normally closed" relay shorts the output for protection of the devices even when the system is powered down. The figure at right shows that no transients occurred during shut down of the laser diode drive current. Also, from the figure it can be observed that the system is capable of setting the laser drive current to zero in approximately 50 µs.

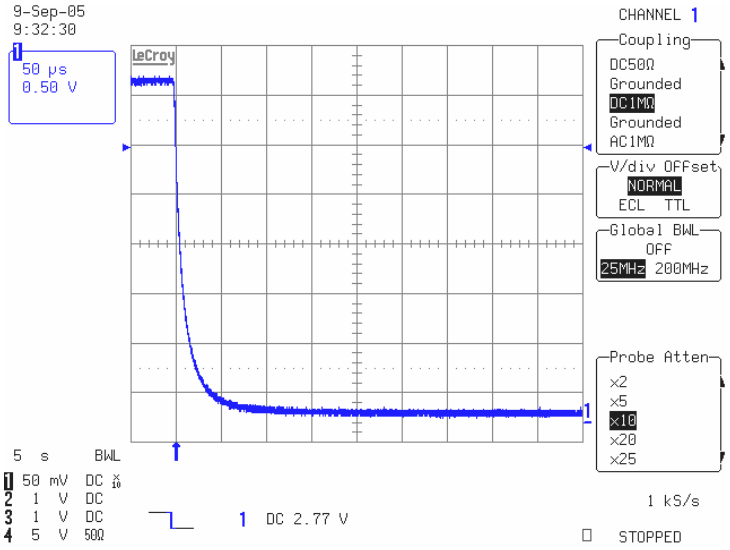

Figure 2

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Loss of AC Power. The LRS-9424B initiates the same shut down sequence when AC power is lost as it does during a normal shut down. An independent power monitor board continuously monitors AC power applied to the system as well as the quality of the DC voltages used within the system. In the event of a fault, a “power bad” signal is sent to all of the system’s control-measure electronics modules and fast shut-down sequences are initiated in hardware. In the figure at right it can be seen that no transients were observed following a loss of AC power and as in the previous test, setting the output to zero occurred in approximately 50µs.

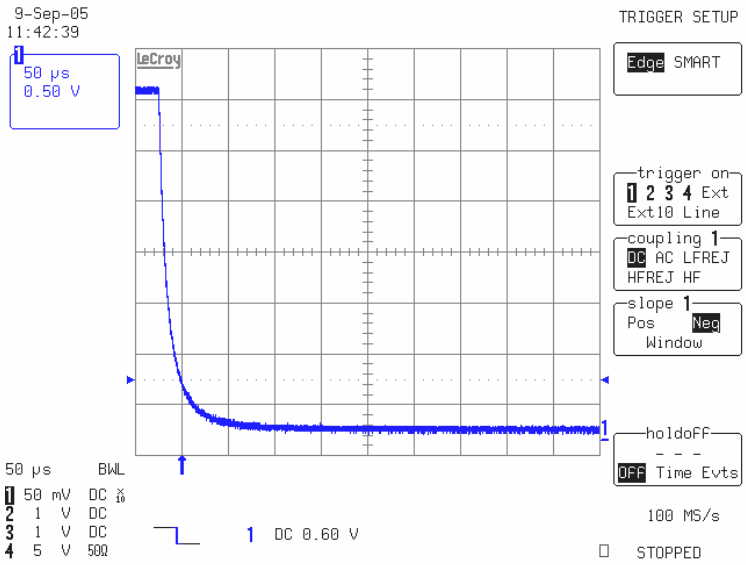

Figure 3

AC Power Line Surge. A 1kV/10A AC power line surge was introduced at the power input of the LRS-9424B. It can be seen in the figure at right that this surge resulted in a 100 mV signal observed on the LeCroy monitoring oscilloscope. Using the measurement transfer function of 136 mA/V a transient of 1.36 mA was calculated. This transient level is well below the specification of 10 mA for the 9424B’s 200 mA control measure module.

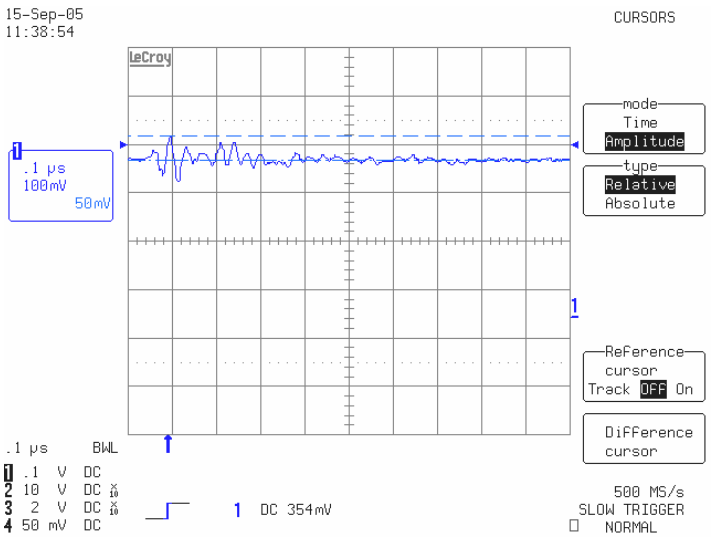

Figure 4

CONCLUSION

The results of the tests reported here show that the LRS-9424B Laser Reliability and Burn-In Test system provides a safe, transient free test environment for static sensitive devices under all anticipated operating conditions. For additional information on laser diode protection please see our Application Note #3, "*Protecting Your Laser Diode*" and for additional information on measuring transients please see our White Paper, "*A Standard for Measuring Transient Suppression of Laser Diode Drivers*."