Analog and Digital Modulation of LQx and DLx Series Laser Diode Modules

LQx and DLx Series Laser Diode Modules

The **LQx** series Fabry-Perot laser diode modules offers the most precise temperature control available from Newport Corporation. The **DLx** Series Distributed Feedback (DFB) Laser Source modules offer exceptionally stable wavelength and narrow spectral width. The LQC and the DLC series represent laser modules with a CW output.

The LQA and DLA series represents laser modules with 20MHz analog beam modulation. The LQD and DLD series represents a laser module with 100MHz TTL digital modulation. Analog modulation requires an input voltage with 0 to 1 VDC modulation on the SMC Connector. A control voltage of 1V will yield a 100% power output. A control voltage of 0VDC will yield a 0% output. The digital, or the transistor-transistor logic (TTL), modulation requires an input voltage of 0 to 5 V. A control voltage of 5V will yield a 0% power output. A control voltage of 0V will yield a 100% output. The laser is either ON or OFF depending on the control voltage.

The laser current at which the laser power is at the modulation low or OFF state is barely above the lasing threshold. Thus the user will still measure finite light intensity. This way the modulation operation of the laser is optimized and the largest possible bandwidth is obtained. It is possible to set the trough current point below threshold, but in that case the modulation bandwidth decreases and distortion at the bottom of the waveform occurs.

Newport can also provide a laser module that is set lower than the threshold when the modulation input is low. Unless the current flow on the laser diode chip is 0 A, there always is emission of light, in the form of amplified spontaneous emission (ASE). However, the ASE an incoherent light and thus shows very low power level as well as a very large divergence angle.

Bias Consideration

The laser chip is biased such that the 0% of the output is still above the lasing threshold. In case the bias is required to result in below-threshold condition, the customer must consider the distortion of the laser output.
Figure 1 describes the effect of the laser bias on the output signal. The first quadrant indicates the power vs time, while the fourth quadrant indicates the driving current vs time. The plot shown in green indicates the signal and current with a bias so that the current at trough is still above threshold. The plot indicates that the laser output closely follow the pattern of the input modulation.
The line in pink indicates a case without the bias. As soon as the current level falls below the threshold, there is no lasing so the power will be suddenly dropped. Therefore, the output signal is distorted and the relationship between the modulation signal and the laser output is no longer linear. The user is recommend to make a decision after considering the trade-offs between the biased vs non-biased cases.

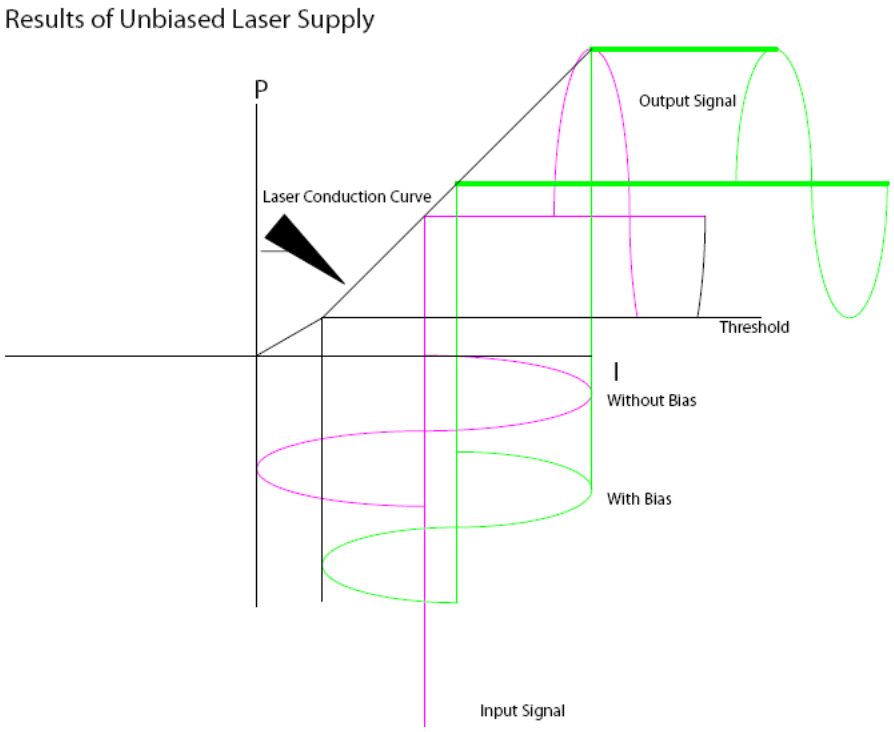

Figure 1. Modulation of input current and output power.

Modulation Waveform Samples

The modulation characteristics vary greatly from one chip to another. However, below is a collection of sample data measured using a fast oscilloscope that shows the modulation behavior of the Newport laser diode modules.

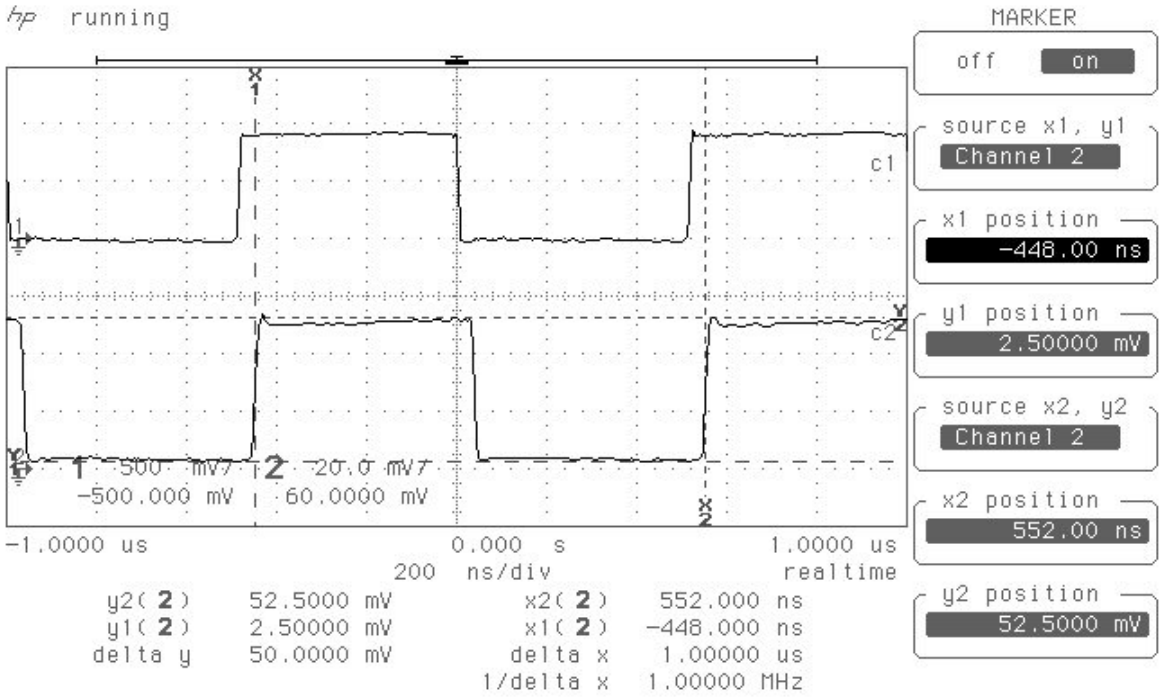

Figure 2. 1 MHz analog modulation for a laser operating at 658 nm.

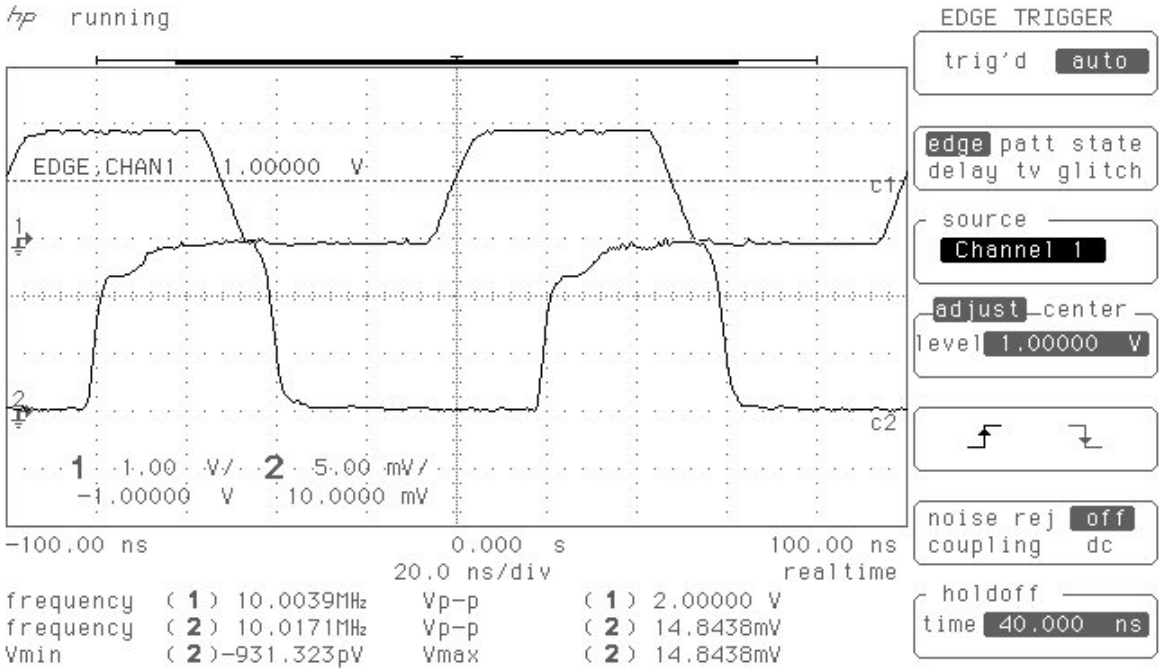

Figure 3. 20 MHz analog modulation for a laser operating at 635 nm.

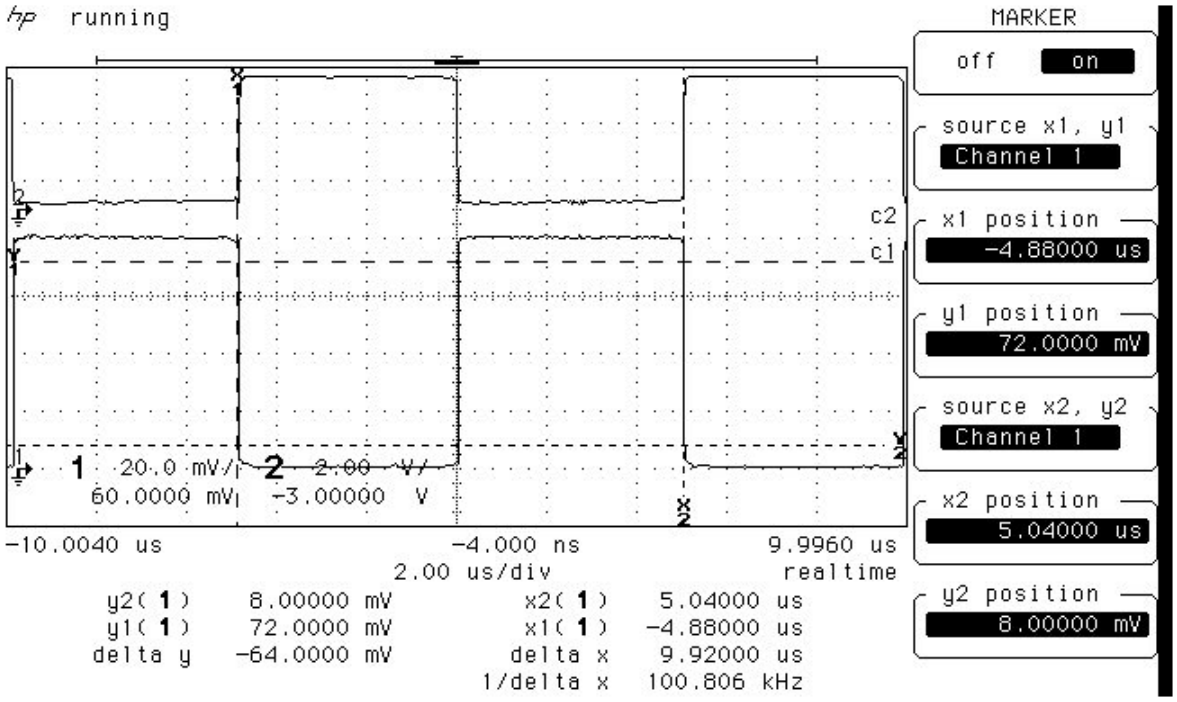

Figure 4. 20 MHz TTL modulation for a laser operating at 405 nm.

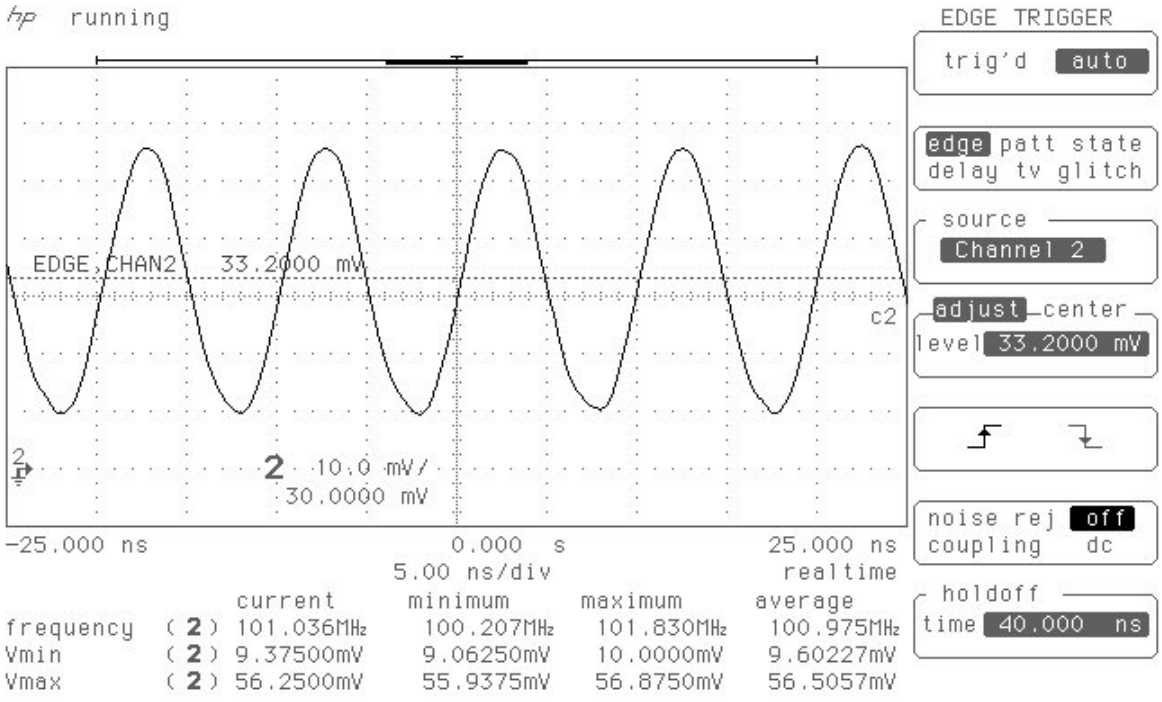

Figure 5 100 MHz TTL modulation for a laser operating at 405 nm.