

OVERVIEW

The ILX Lightwave LDX-3500B Series Precision Current Source can be modulated by an external analog signal up to 500 kHz, 150 kHz or 100 kHz depending on the model. The analog modulation port will accept digital pulses with limited performance.

The purpose of this technical note is to define the digital modulation bandwidth of the LDX-3500B Series Precision Current Source.

TEST SET UP

An LDX-3545B Laser Diode Current Source and an LDT-5525B Thermoelectric Temperature Controller were connected to an LDM-4984 Butterfly Laser Diode Mount loaded with an NEL1556STG butterfly laser diode. The fiber coupled output was connected to a 125 MHz New Focus 1811 photodetector.

A Tektronix AFG 320 Arbitrary Function Generator was connected to the modulation input port of the LDX-3545B. The function generator output a square wave that modulated the output current to approximately 220 mA, which correlates to 2.2V in the 1A output range and 0.7V in the 3A output range.

Traces from the function generator and the photodetector were displayed on a Tektronix TDS 3014 100 MHz Oscilloscope.

A diagram of the setup is in Figure 1.

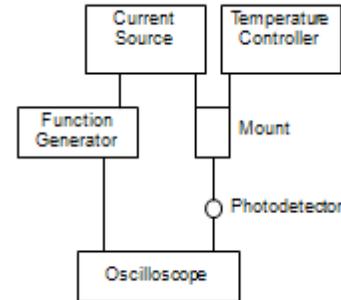


Figure 1: The test setup to determine the digital modulation bandwidth of the LDX-3500B Series Precision Current Source.

TEST PROCEDURE

The output of the LDX-3545B, operated in high bandwidth mode, I_{HBW} , was enabled in the 1A output range and the frequency of the square wave was set to 150 kHz. The resulting traces were recorded in a screen capture.

The frequency of the square wave was reduced until the output was capable of reaching the maximum and minimum output settings without clipping. The resulting traces were recorded again.

The process above was repeated for the 3A output range beginning with a 50 kHz square wave.

TECH NOTE

RESULTS

The analog modulation bandwidth specification in the 1A output range is 150 kHz. The screen capture in Figure 2 shows the response of the output to a 150 kHz digitally modulated input signal.

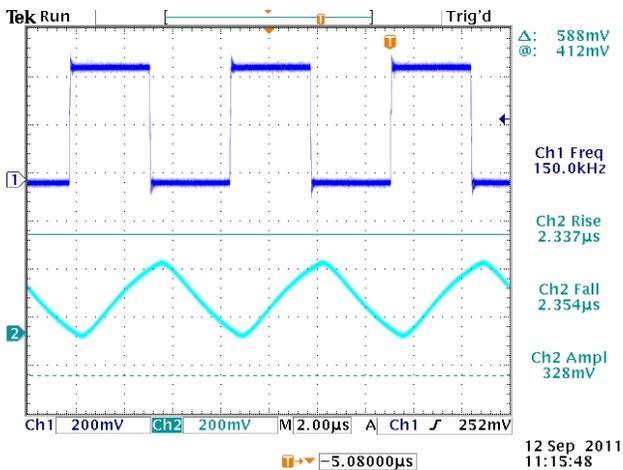


Figure 2: The response of the LDX-3545B in the low output range (Light Blue) to digital modulation with a frequency of 150 kHz (Dark Blue).

The output in Figure 2 does not reach the maximum and minimum output settings, indicated by the sawtooth pulse shape. The rise and fall times are long compared to the pulse widths of the input signal which causes the pulses to be clipped.

As Figure 3 shows, the output reaches the maximum and minimum output settings without clipping at 45 kHz; therefore, the digital modulation bandwidth for the 1A output range of the LDX-3545B is 45 kHz. While the pulses in Figure 3 are acceptable, the shape will only improve at frequencies lower than 45 kHz. That implies that the LDX-3545B can accept pulses 22 μs and longer in the low output range.

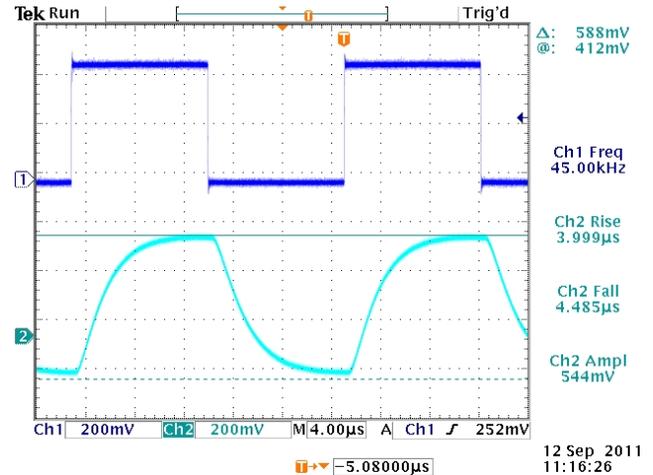


Figure 3: The response of the LDX-3545B in the low output range (Light Blue) to digital modulation with a frequency of 45 kHz (Dark Blue).

The analog modulation bandwidth in the 3A output range of the LDX-3545B is 50 kHz. Figure 4 shows the output responding to the input of a 50 kHz square wave. Similar to Figure 2, the pulse has a sawtooth shape because the rise and fall times are longer than the input pulse width.

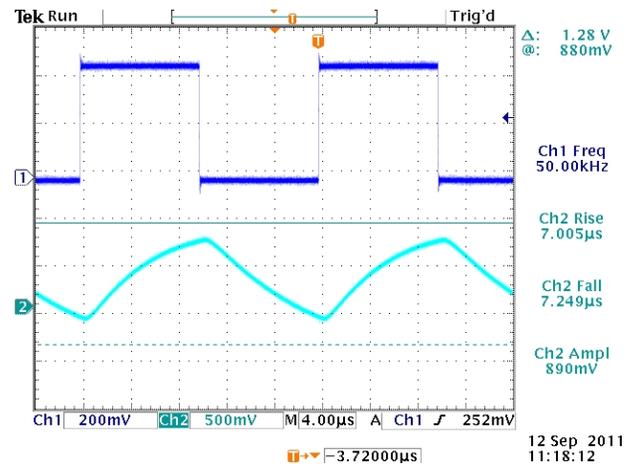


Figure 4: The response of the LDX-3545B in the high output range (Light Blue) to digital modulation with a frequency of 50 kHz (Dark Blue).

TECH NOTE

The screen capture in Figure 5 shows the pulses resulting from a 15 kHz square wave input. The shape is clearly defined and the pulse shape will continue to improve with the input of a square wave with a frequency of less than 15 kHz. That implies that the LDX-3545B operating in high output range can accept pulses of 67 μ s or longer.

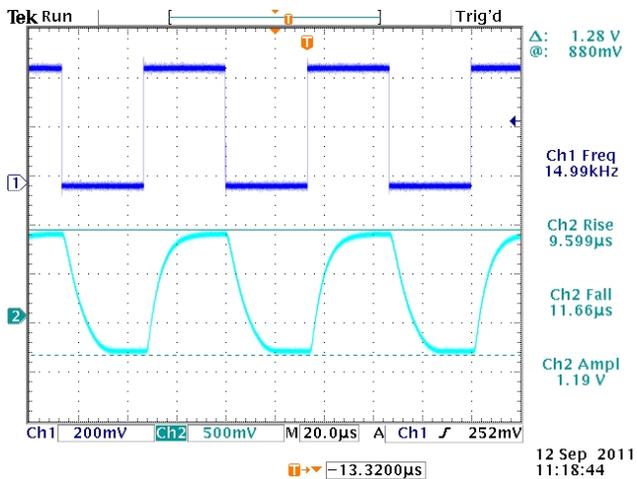


Figure 5: The response of the LDX-3545B in the high output range (Light Blue) to digital modulation with a frequency of 15 kHz (Dark Blue).

CONCLUSION

The low bandwidth mode or CW mode is not intended for external modulation, especially not digital modulation. In high bandwidth mode, the digital modulation bandwidth of the LDX-3545B in the 1A range is 45 kHz with an input voltage of 2.2V and in the 3A range is 15 kHz with an input voltage of 0.7V. The current source forms acceptable pulses that are greater than 22 μ s or 67 μ s in duration for the 1A and 3A output ranges, respectively.

The digital modulation bandwidth is determined by the operating current input voltage of the modulating signal. The bandwidth is reduced as the input voltage is increased.

For clean pulses with short rise and fall times, ILX Lightwave recommends the LDP-3811 or the LDP-3840B Pulsed Precision Current Sources.