TECH NOTE

Laser Drive Current Setpoint Accuracy of the LRS-9550

PURPOSE

This technical note describes the current source design and setpoint accuracy validation of the LRS-9550 High Power Laser Diode Test System.

BACKGROUND

The LRS-9550 is a laser diode test system designed for reliability testing and burn-in of optical devices, with maximum drive current sources up to 30A. Over the full range, the LRS-9550 has a rated laser drive current setpoint accuracy of ±50mA. This accuracy is critical in determining threshold current values and overall LIV measurements.

Through the ReliaTest software interface, users can set drive current setpoints for burn-in, or step increments for an LIV process, taking in-situ measurements during the test. These drive current setting values are used to calculate key parameters, utilizing the measured voltage and photodiode parameters.

OVERVIEW OF DESIGN

To maintain the hardware's high degree of drive current setpoint accuracy, while excluding any possible sources of reported measurement errors in the software, the ILX Lightwave® team designed the LRS-9550 without active current readings to the user. Figure 1 showcases the simplified design of each individual current source present in the LRS-9550 system.

The end user communicates to the microcontroller embedded in the LRS-9550 shelves via ReliaTest, setting the desired current setpoints or LIV step sizes. This setpoint value is used for reporting the current (I) value in the ReliaTest LIV scan. Additionally, this value is sent to the internal current source's digital-to-analog converter (DAC) for driving the laser diodes.

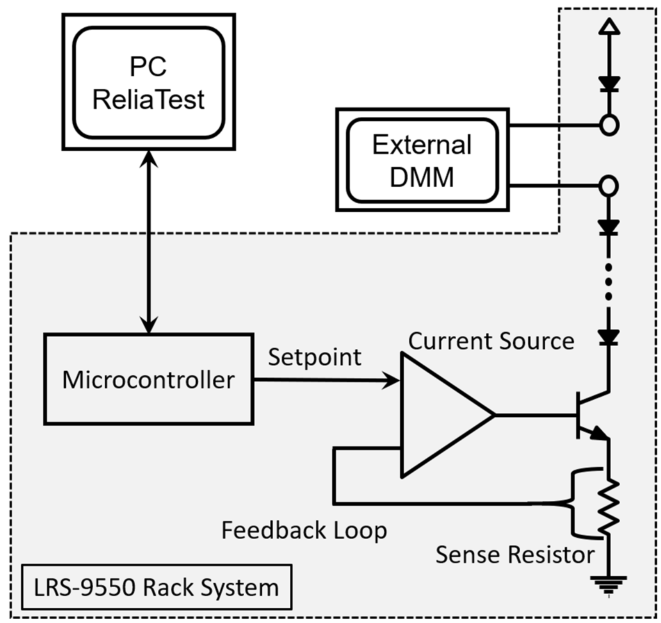

Figure 1: Simplified current source circuit diagram

Through the use of a transistor and sense resistor, a feedback loop is created to ensure the desired setpoint value is maintained and adjusted properly for the various LIV current step increments.

While an additional analog-to-digital converter (ADC) circuit could be employed within the feedback loop for active current measurement read-outs, this circuitry would add a source of measurement error and could make the subsequent LIV data unreliable. Our single DAC design also provides a faster setting response time over this theoretical ADC – DAC control loop addition in the feedback.

TECH NOTE

SETPOINT ACCURACY VALIDATION

The design relies on a precise calibration and verification approach during the construction and testing of each current source module, to meet the ±50mA specification.

Shown in figure 1, an external NIST traceable Digital Multimeter (DMM) is employed for finite current measurements, by utilizing test loads at the individual Device Under Test (DUT) locations or channels. A Keysight 34980A multimeter mainframe with a 34922A module is used as the DMM to validate our microcontroller setpoints.

To determine setpoint accuracies, a calibration procedure is used with specific values on the current source digital-to-analog converters (CMM DACs). As shown in figure 2, a sample calibration log excerpt is displayed, with set DAC points relating to DMM measured current values. Our combined calibration set-up has a current setpoint accuracy check of ±15mA, exceeding our ±50mA LRS-9550 current source specification.

After each channel is checked at various current levels (5 different setpoints in each iteration), individual LDI channel slope and intercept values are calculated, retested, and stored to the microcontroller hardware, to ensure consistency and accuracy for end use.

SUMMARY

The LRS-9550 High Power Laser Diode Test System is designed to operate at stringent current setpoint accuracy values, eliminating any potential sources of measurement and reporting error due to continuous feedback readings from an additional analog-to-digital circuitry. Our current sources are calibrated at a ±15mA accuracy tolerance via an external DMM, greater than the ±50mA LRS-9550 setpoint specification.

For optimal performance, ILX Lightwave® recommends an annual calibration cycle on the individual current sources integrated into each LRS-9550 shelf. Contact your local sales representative for more information on available service options.

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LDI 3 @ 10:30 AM

CMM DACs:  5300 ,  5300 ,  5300 ,  5300
DMM Amps:  0.7809 ,  0.7874 ,  0.7711 ,  0.7795

CMM DACs:  9800 ,  9800 ,  9800 ,  9800
DMM Amps:  1.5595 ,  1.5619 ,  1.5469 ,  1.5556

CMM DACs:  14300 ,  14300 ,  14300 ,  14300
DMM Amps:  2.3381 ,  2.3353 ,  2.3203 ,  2.3327

CMM DACs:  18800 ,  18800 ,  18800 ,  18800
DMM Amps:  3.1168 ,  3.1091 ,  3.0935 ,  3.1085

CMM DACs:  23300 ,  23300 ,  23300 ,  23300
DMM Amps:  3.8930 ,  3.8810 ,  3.8653 ,  3.8834

Channel 09 LDI Intercept:  781.489 Slope:  5782.974 -- pass
Channel 10 LDI Intercept:  714.995 Slope:  5818.160 -- pass
Channel 11 LDI Intercept:  806.305 Slope:  5817.727 -- pass
Channel 12 LDI Intercept:  778.175 Slope:  5798.496 -- pass

Storing successful LDI calibrations...Done
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LDI 3 @ 10:31 AM

CMM DACs:  5997 ,  5997 ,  5997 ,  5997
DMM Amps:  0.8994 ,  0.9000 ,  0.8989 ,  0.8998

CMM DACs:  11215 ,  11215 ,  11215 ,  11215
DMM Amps:  1.8006 ,  1.8003 ,  1.8009 ,  1.8005

CMM DACs:  16434 ,  16434 ,  16434 ,  16434
DMM Amps:  2.7017 ,  2.7005 ,  2.7003 ,  2.7003

CMM DACs:  21653 ,  21653 ,  21653 ,  21653
DMM Amps:  3.5996 ,  3.5993 ,  3.5993 ,  3.5996

CMM DACs:  26871 ,  26871 ,  26871 ,  26871
DMM Amps:  4.4978 ,  4.4984 ,  4.4975 ,  4.4972

Channel 09 LDI Intercept:  771.968 Slope:  5801.108 -- pass
Channel 10 LDI Intercept:  772.537 Slope:  5801.175 -- pass
Channel 11 LDI Intercept:  774.239 Slope:  5801.239 -- pass
Channel 12 LDI Intercept:  770.374 Slope:  5802.421 -- pass

Storing successful LDI calibrations...Done
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Figure 2: Sample calibration log excerpt, LDI slope and intercept values