LRS-9434 Temperature Set Point Accuracy

OVERVIEW

Given the delicate relationship between the output of laser diodes and temperature, the success of any burn-in or life test is contingent on the test system's ability to accurately and uniformly control device temperature.

The LRS-9434 Test System utilizes a family of fixtures that are designed to ensure set point accuracy of ± 2.0°C across a range of 40°C to 150°C. Temperature set point accuracy is defined as the difference between temperature set point and actual temperature measured on the fixture heater plate adjacent to any device location. Temperature set point accuracy takes into account both accuracy of temperature control and uniformity across all device locations. Temperature control is accomplished through the use of AD590 temperature sensors, and a combination of cartridge heating and regulated air cooling. Temperature set point accuracy is optimized through fixture geometry and an advanced temperature control algorithm.

TEST SET UP

An LRS-9434 fixture was fitted with three 4-wire RTDs, placed in the device heater plate at the front, middle, and back of the fixture. An Agilent DAQ control unit (34970A) with an Agilent 20-channel multiplexer (34901A) was used to monitor the output of the three RTDs. Resistive loads (each capable of outputting 0.5W of heating power) were placed on each of the 32 device locations on the fixture, in order to mimic the heating load of real laser diodes. Power and air flow for the fixture were provided by an LRS-9434 Control Measure Module. RTD measurements were outputted to a .csv file so that they could be compared once testing was complete.

TEST PROCEDURE

Fixture heater plate temperature at each of the three locations was monitored while the temperature set point was varied from 40°C to 150°C in 10 degree increments.

At each temperature set point, total device waste heat was varied between 0W and 16W. In each condition and location the actual temperature was compared to set point.

RESULTS

The image in FIGURE 1 shows a plot of temperature error at different powers, temperatures, and locations. The maximum spread from lowest to highest reading (shown in purple) tends to increase at higher temperatures and most conditions have a positive error. trick

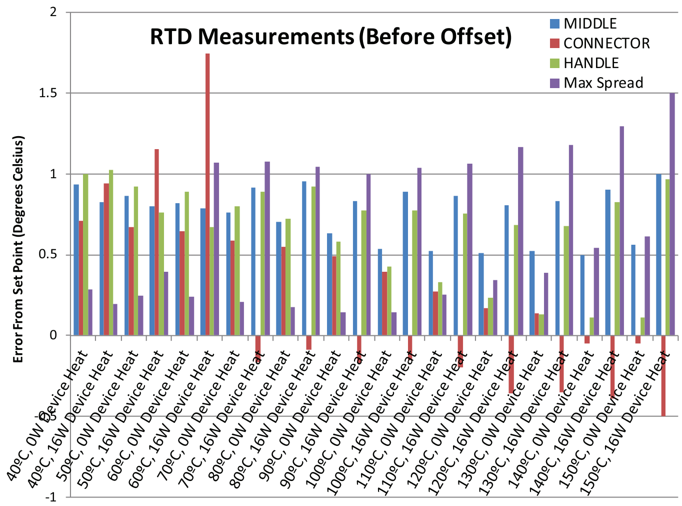

FIGURE 1

OPTIMIZATION OF ACCURACY

Under operation, temperature is measured and controlled by a single AD590 located near the center of the fixture. Local temperature gradients exist on the fixture heater plate and these gradients increase at higher temperatures. These gradients are characteristic of the fixture geometry and result in generally increasing error at higher temperatures (as seen in FIGURES 1 and 2). By characterizing this effect, the error relative to set point can be reduced.

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At each temperature set point the temperature offset of each of the RTDs, with respect to set point, were plotted and compared to each other (FIGURE 2). When a linear best fit curve was applied to this plot, the resulting equation yielded slope and offset values, which were then applied to the AD590 measurements in the temperature control algorithm. This applied correction factor minimizes the temperature variation versus set point across the fixture heater plate throughout the temperature control range.

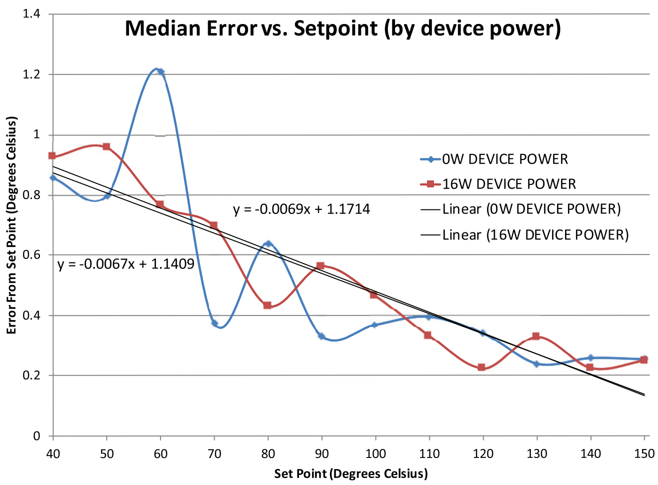

FIGURE 2

Once the slope and offset values were applied to the fixture, the 40°C to 150°C test was repeated, and the results were again plotted to show temperature set point vs. the difference between set point and actual temperature (temperature error). See FIGURE 3 vs. the difference between set point and actual temperature (temperature error). See FIGURE 3

Note that before adding the slope and offset values (FIGURE 1) nearly all of the RTD measurements were hotter than the set point, some bordering +2.0°C. After adding the slope and offset values, the median of the RTD values sits much closer to the set point, the maximum error not exceeding ±1.0°C.

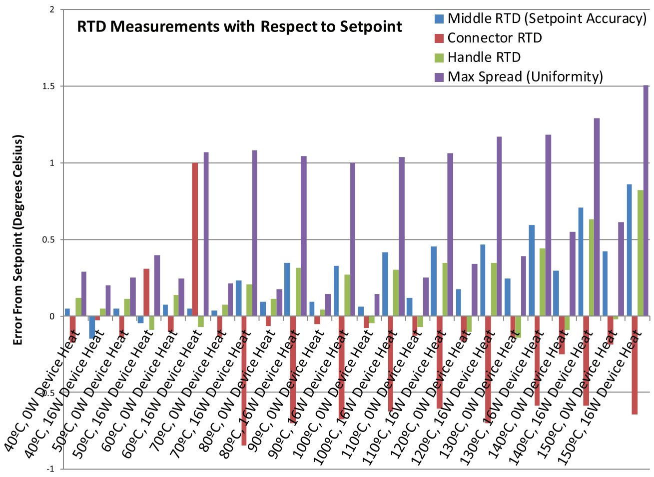

FIGURE 3

The maximum temperature spread from the coldest to the hottest RTD temperature is shown in purple in FIGURE 1 and FIGURE 3. This value is the best representation of the temperature uniformity, as it shows the widest possible temperature differential that could exist between any two device locations in the fixture.

CONCLUSION

The LRS-9434 Test System Fixture is capable of providing temperature set point accuracy of better than ±2.0°C across the entire 40°C to 150°C range.

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The following publications are available for download at www.newport.com/ilxlightwave.

White Papers

- A Standard for Measuring Transient Suppression of Laser Diode Drivers
- Calibration and Traceability Ensure Measurement Accuracy
- Degree of Polarization vs. Poincare Sphere Coverage
- Improving Splice Loss Measurement Repeatability
- Laser Diode Bum-In and Reliability Testin
- Power Supplies: Performance Factors Characterize High Power Laser Diode Drivers
- Simplifying Parametric Analysis of Laser Diodes
- Reliability Counts for Laser Diodes
- Reducing the Cost of Test in Laser Diode Manufacturing

Technical Notes

- Accuracy and Repeatability of Power Measurements Using the FPM-8220
- Automatic Wavelength Compensation of Photodiode Power Measurements Using the OMM-6810B Optical Multimeter
- Bandwidth of OMM-6810B Optical Multimeter Analog Output
- Broadband Noise Measurements for Laser Diode Current Sources
- Callendar-Van Dusen Equation and RTD Temperature Sensors
- Clamping Limit of an LDX-3525B Precision Current Source
- Connecting Your Laser to the LDP-3830
- Determining the Polarization Response of the FPM-8220
- Effects of Cabling and Inductance When Pulsing High Power Laser Diodes
- Facility Power Requirements for the LDX-36000
- Four-Wire TEC Voltage Measurement with the LDT-5900 Series
- Guide to Selecting a Bias-T Laser Diode Mount
- High Power Linearity of the OMM-6810B and OMH-6790B Detector Heads
- Large-Signal Frequency Response of the 3916338 Current Source Module
- Laser Wavelength Measuring Using a Colored Glass Filter
- LDC-3736 Laser Protection
- LDM-4982 and 4984 Quick Setup Guide
- LDP-3830 Independent Current Limit
- LDP-3830 Laser Protection
- LDP-3830 Pulse Performance
- LDT-5900C Temperature Stability
- LDT-5910C PID Control Quick Start
- LDT-5940C Voltage Measurement Techniques
- LDX-3232 Modulation Bandwidth
- LDX-36000 CQW Pulse Characteristics
- Long-Term Output Stability of an LDX-3620B Laser Diode Current Source
- Long-Term Output Stability of an LDX-3525B Precision Current Source
- LRS-9434 Temperature Set Point Accuracy
- LRS-9434 Temperature Coefficient
- LRS-9434 Threshold Current Measurement Repeatability
- LRS-9434 and LMS-9406 Transient Protection
- LRS-9550 Device Temperature Algorithm
- LRS-9550 Fixture Temperature Range
- LRS-9550 Laser Drive Current Setpoint Accuracy
- LRS-9550 Laser Eye Safety Features
- LRS-9550 Water Quality Guidelines
- Measurement of 4-Wire Voltage Sense on an LDC-3916 Controller
- Measuring the Power and Wavelength of Pulsed Sources Using the OMM-6810B Optical Multimeter
- Measuring the Wavelength of Noisy Sources Using the OMM-6810B
- Minimum Temperature Range of the LDM-4405
- Minimum Temperature Control Range of the LDM-4982M / LDM-4894T
- Nominal PID Constants for the LDT-5900 Series Controller
- Output Current Accuracy of an LDX-3525B Precision Current Source
- Paralleling Laser Diodes
- Pulse Parameters and LDP-3830 Control Modes
- Quick Start: Modulation a Laser Diode Driver
- Repeatability of Wavelength and Power Measurements Using the OMM-6810B Optical Multimeter
- Square Wave Modulation of the LDX-3500B
- Stability of the OMM-6810B Optical Multimeter and OMH-6727B InGaAs Power/Wavehead
- Temperature Control Range of the LDM-4409
- Temperature Measurement Using a Linearized Thermistor Network
- Temperature Stability Using the LDT-5948 / LDT-5980
- Thermal Resistance of the LDM-4409
- Thermistor Constant Conversions: Beta to Steinhart-Hart
- Triboelectric Effects in High Precision Temperature Measurements
- Tuning the LDP-3840B for Optimum Pulse Response
- Typical Long-Term Temperature Stability of a LDT-5525 TEC
- Typical Output Drift / Noise of an LDX-3412
- Typical Temperature Stability of the LDT-5500B
- Using Status Event Registers for Event Monitoring
- Using the Dual Modulation Inputs of the LDX-3620B
- Using the LDM-4984 with the LDP-3840B
- Using Three-Wire RTDs with the LDT-5900 Series Temperature Controllers
- Voltage Drop Across High Current Laser Interconnect Cable
- Voltage Drop Across High Current TEC Interconnect Cable
- Voltage Limit Protection of an LDC-3916 Laser Diode Controller

Application Notes

- App Note 1: Controlling Temperatures of Diode Lasers Thermoelectrically
- App Note 2: Selecting and Using Thermistors for Temperature Control
- App Note 3: Protecting Your Laser Diode
- App Note 4: Thermistor Calibration and the Steinhart-Hart Equation
- App Note 5: An Overview of Laser Diode Characteristics
- App Note 6: Choosing the Right Laser Diode Mount for Your Application
- App Note 8: Mode Hopping in Semiconductor Lasers
- App Note 11: Pulsing a Laser Diode
- App Note 12: The Differences between Threshold Current Calculation Methods
- App Note 13: Testing Bond Quality by Measuring Thermal Resistance of Laser Diodes

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(Application Notes continued)

The following publications are available for download at www.newport.com/ilxlightwave.

- App Note 14: Optimizing TEC Drive Current
- App Note 16: Measuring Wide Linewidth Source with the OMH-6700B Series Waveheads
- App Note 17: AD590 and LM335 Sensor Calibration
- App Note 18: Basic Test Methods for Passive Fiber Optic Components
- App Note 20: PID Control Loops in Thermoelectric Temperature Controllers
- App Note 21: High Performance Temperature Control in Laser Diode Test Applications
- App Note 22: Modulating Laser Diodes
- App Note 23: Laser Diode Reliability and Burn-In Testing
- App Note 25: Novel Power Meter Design Minimizes Fiber Power Measurement Inaccuracies
- App Note 26: ReliaTest L/I Threshold Calculations
- App Note 27: Intensity Noise Performance of Semiconductor Lasers
- App Note 28: Characterization of High Power Laser Diode Bars
- App Note 29: Accelerated Aging Test of 1310 nm Laser Diodes
- App Note 30: Measuring High Power Laser Diode Junction Temperature and Package Thermal Impedance
- App Note 31: Mounting Considerations for High Power Laser Diodes
- App Note 32: Using a Power/ Wavehead for Emitter Level Screening of High Power Laser Diode Bars
- App Note 33: Estimating Laser Diode Lifetimes and Activation Energy
- App Note 34: Using USB Through Virtual COM Ports
- App Note 37: Measuring and Reducing Noise Using an LDX-3620B Ultra
- Low Noise Laser Diode Current Source
- App Note 38: Achieving Millikelvin Temperature Stability

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