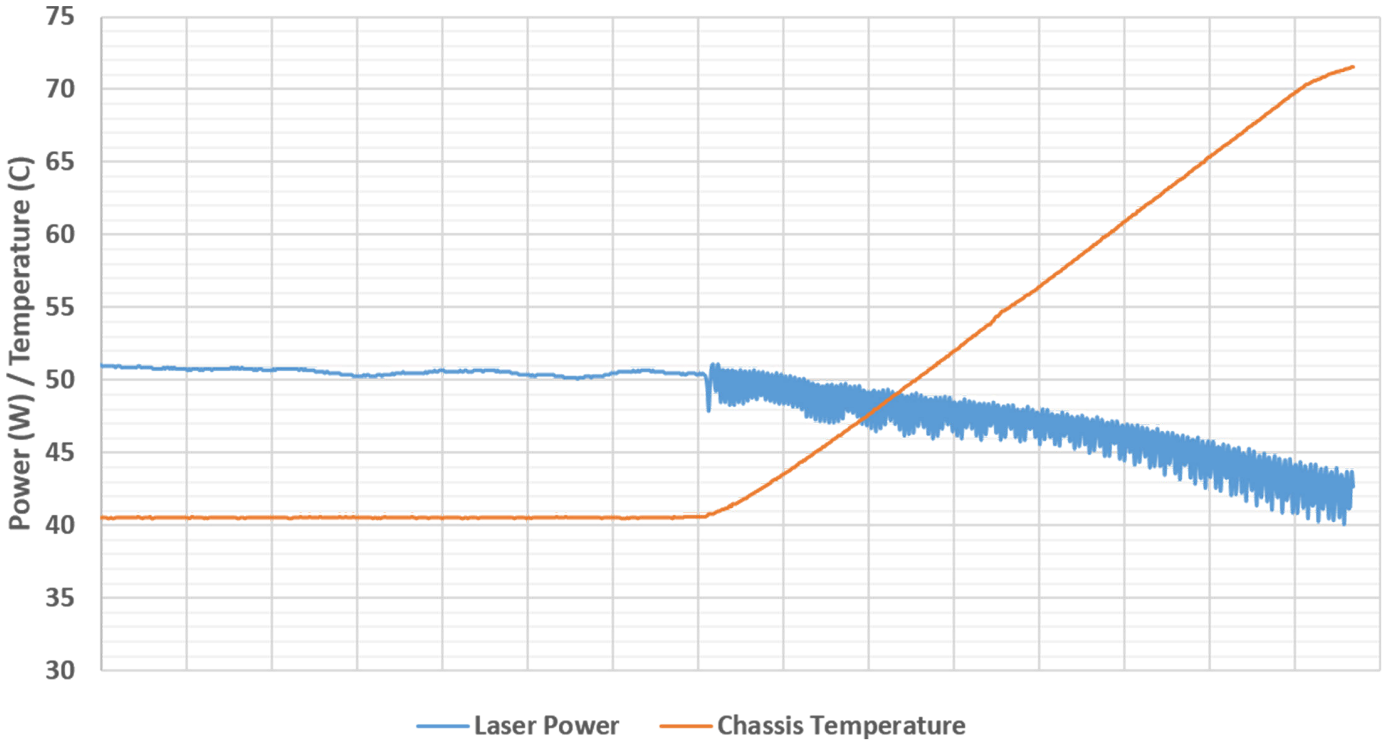
Monitoring Temperature to Ensure Optimal Performance of Synrad CO_2 Lasers

Within any integrated manufacturing or processing system, avoiding unplanned downtime due to component failure is critical. Modern predictive maintenance systems provide operations managers with warnings when negative trends indicating potential shutdown are spotted. Many critical components within a manufacturing or processing system have unique performance indicators—for Synrad sealed CO_2 lasers, one critical performance metric is tube temperature, which has a direct impact on output power. When operated beyond specified temperature limits, CO_2 lasers can suffer a decrease in output power and correspondingly, power stability.

Laser Performance and Tube Temperature

For sealed CO_2 lasers, higher tube temperatures can cause a decrease in the electrical to optical conversion efficiency, resulting in lower laser output power.



Changes in cooling system performance during steady state operation can cause power stability fluctuations and an overall drop in laser output power as shown in the chart above. The vi40 Temperature Broadcast feature can be used to sense changes in machine cooling performance and respond accordingly - before a change in application performance is noticed.

Maintaining the recommended operating temperatures for sealed CO_2 lasers is critical. The use of secondary cooling mechanisms like fans or flowing water systems are commonly added to assist cooling.

Fluctuating temperatures can also impact output power stability. It is therefore critical to maintain the laser tube temperature within specified operational boundaries to ensure optimal performance. There are several factors that can affect the temperature of the laser tube:

- **Ambient conditions** – The ambient temperature of the operational environment will affect laser performance, causing an overall increase or decrease in the temperature of the laser tube, regardless of operational state.
- **Cooling systems** – Sealed CO_2 lasers are generally cooled with water or forced air (fans). In most cases these systems are sufficient, but a change in cooling system performance can have a drastic impact on laser power.
- **Laser operation** – The pulse width modulation (PWM) parameters of the laser also play a part in tube temperature. High duty cycle operation will drive increased laser tube temperatures.

By monitoring the laser temperature, control systems can analyze trends which may signal an issue with the machine cooling system and alert operators to take corrective action to prevent downtime. Integrating laser diagnostics into machine control systems can allow for smart control of cooling systems, with the benefit of reduced operational costs. This is especially true of fan-cooled lasers, where the fans can potentially be operated at reduced levels depending on environmental and operational parameters.

Active Synrad CO_2 Laser Temperature Monitoring

Selected Synrad CO_2 lasers feature active temperature monitoring to provide real-time laser temperature information. The temperature data can be used for preventative maintenance, remote troubleshooting, performance optimization, and smart system design.

Users now have access to the laser tube temperature to verify the effectiveness of cooling systems and monitor system health and performance in real time. The data can also be used to predict laser safety shutdown due to overheating, allowing corrective action to prevent potential delays in production. Temperature data is captured and transmitted at 250 millisecond intervals on a user output line, accessible on the laser DB-9 I/O connector. The laser chassis and laser tube temperatures are directly proportional, and in turn have a direct impact on laser output power and stability.

During the machine design process, system engineers can determine the most effective and cost-efficient methods for cooling by measuring temperature more easily and accurately active temperature monitoring.

Maintaining a constant laser tube temperature during operation can also improve long term power stability. Drifts in laser temperature due to cooling systems or ambient conditions can cause fluctuations in laser output power. Data from active Synrad CO_2 laser temperature monitoring can be integrated into machine cooling control systems, providing a feedback signal for laser temperature regulation and better long term power stability.

Temperature Broadcast has many benefits and can lead to improvements in:

- Performance – By closely monitoring and maintaining the laser's temperature, users can ensure
  optimal laser power output and long term stability.
- Cost Savings – Reduced downtime via early warning and preventative maintenance. Smart control of cooling systems can also reduce operational costs.
- Environmental Conditions – Accurate control of cooling systems is increasingly critical in more demanding environments, allowing Synrad lasers with active temperature monitoring to be safely integrated and operate in tougher conditions.
- System Monitoring – Real-time laser temperature data can be correlated to system health and performance and allow remote troubleshooting.

Novanta is committed to delivering high quality solutions to real world applications where reliability and uptime are critical. Active temperature monitoring in Synrad lasers enables users to harness the power of diagnostic data and take control of CO_2 laser system performance and maximize productivity.

Interested in speaking to one of our knowledgeable representatives?

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