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Maximizing uptime

How novel designs and flexible training enable world-class service

In the past decade, fiber lasers have come to dominate laser-based industrial materials processing because they provide an unmatched combination of low cost of ownership, low per-part cost of production and high reliability.[1,2] No other technology offers a comparable set of performance and practical advantages, and fiber lasers are expected to continue growing their market share over other types of lasers and non-laser technologies.

Adoption of fiber lasers is increasing in established applications such as metal cutting, welding and cladding. Fiber lasers also enable several emerging applications such as additive manufacturing and non-metal processing.

A key advantage of fiber lasers is reliability. They require no consumables other than electricity; require no optical alignment, routine maintenance or calibration; and exhibit extraordinarily long life when designed around the right high-performance components.[3]

Furthermore, next-generation fiber lasers have incorporated robust, hardware-based protection against back-reflections from the workpiece.[4] Even with fiber lasers' unprecedented reliability, the need for service might occur. In this situation, rapid diagnosis and repair are critical to minimize loss of productivity and, therefore, any repair should be performed at the machine to minimize downtime.

Unfortunately, there are some lasers that fall short of these critical requirements where the tool integrator is unable to repair or diagnose the source of the failure, making the end user dependent on the laser manufacturer for help in returning to productivity. In addition, the lack of serviceability and environmental requirements of the laser may require it to be removed from the machine and transported to the laser manufacturer's remote depot for service, substantially increasing downtime and costs. Tool integrators and their customers identify these serviceability issues as a critical limitation and, correspondingly, as an opportunity for improvements that can accelerate the adoption of fiber lasers throughout the materials processing market.

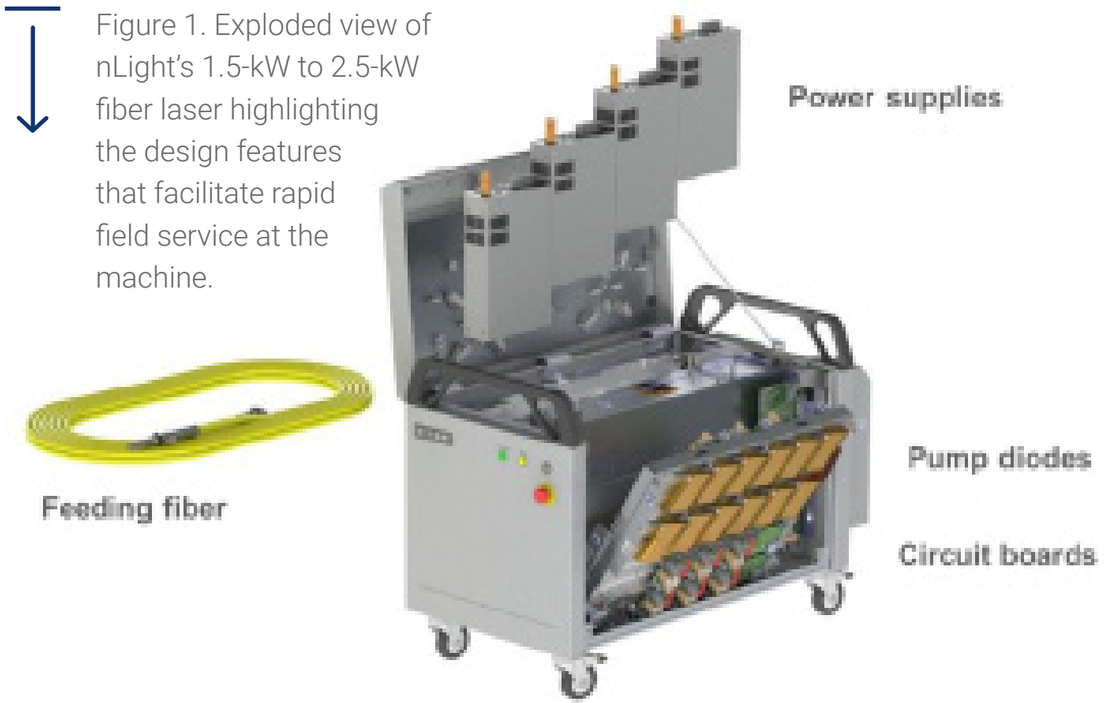
Service made simple

Recognizing the importance of serviceability, nLight designed its next-generation fiber lasers to facilitate rapid, on-site service, if needed. Also, its flexible training program enables tool integrators to diagnose and repair the most common sources of failure.

These steps address the full range of serviceability issues, including those that are innate to a component of the laser, such as failure of a power supply, as well as those caused by use conditions, such as burning the end face of the feeding fiber. With these advances, tool integrators can now take ownership of the end user experience, and their customers can count on recovering quickly when service is needed without uncertainty about the scheduling, duration, cost or responsibility for the service event.

Figure 1 shows nLight's 1.5-kW to 2.5-kW fiber laser features that facilitate →

Figure 1. Exploded view of nLight's 1.5-kW to 2.5-kW fiber laser highlighting the design features that facilitate rapid field service at the machine.



Even with fiber lasers' unprecedented reliability, the need for service might occur.

field service. The chassis includes hinged or removable panels to allow easy access to internal components. The cold plates are hinged to provide access to both sides. Routing of fibers and cables is defined by internal features and includes service loops to ensure rapid and safe service procedures. As a result, electrical components, such as power supplies, circuit boards and optical components, such as the feeding fiber, can be quickly replaced in the field.

Figure 2 (on page 20) shows an example of the design-for-serviceability approach employed for nLight's 3-kW to 8-kW fiber lasers. For comparison, Figure 2a shows a fiber laser that is comprised of multiple, lower power (typically single-mode) fiber lasers with a combined output. This architecture has several drawbacks, including lack of serviceability of the fiber laser building blocks and the need for highly sophisticated personnel and equipment to replace the individual fiber lasers.

Conversely, nLight's multi-kilowatt fiber lasers house the pump diodes and drivers in standalone pump modules and the gain fibers in one or more gain modules that can each generate up to 4 kW of output power (see Figure 2b). These pump and gain modules employ fibers with much larger core diameters than those of the fiber laser building blocks used in the architecture of Figure 2a, which greatly relaxes the alignment tolerances for fiber splicing. As a result, replacing the pump or gain modules requires relatively simple equipment and procedures and can be accomplished in a factory environment.

Overall, nLight's fiber lasers are designed to facilitate rapid field service. Most service tasks can be accomplished in less than two hours and do not require uninstalling the laser from the machine.

A key step in servicing a laser-based machine is to identify the root cause of the problem. Determining whether an issue is caused by the laser or by another subsystem, such as the process head or control electronics, can be time consuming. →

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nLight's fiber lasers incorporate multiple sensors to monitor the status and functioning of the laser. The logged sensor readings can be accessed remotely and enable accurate diagnosis and root-cause analysis. These capabilities expedite troubleshooting and recovery from a service event.

Empowering tool integrators

nLight provides prompt service worldwide, but nonetheless, many integrators want to take responsibility for servicing the total system, including the fiber laser itself, to manage their customer relationships. To support the goals of unified service and support, the design of nLight's next-generation fiber lasers enables laser diagnosis and service by integrators.

Furthermore, nLight has developed a flexible training program to ensure that integrators are fully qualified to conduct diagnostic and repair activities according to their business strategy; to date, many integrators have completed this training. As an extra layer of security to integrators and their →

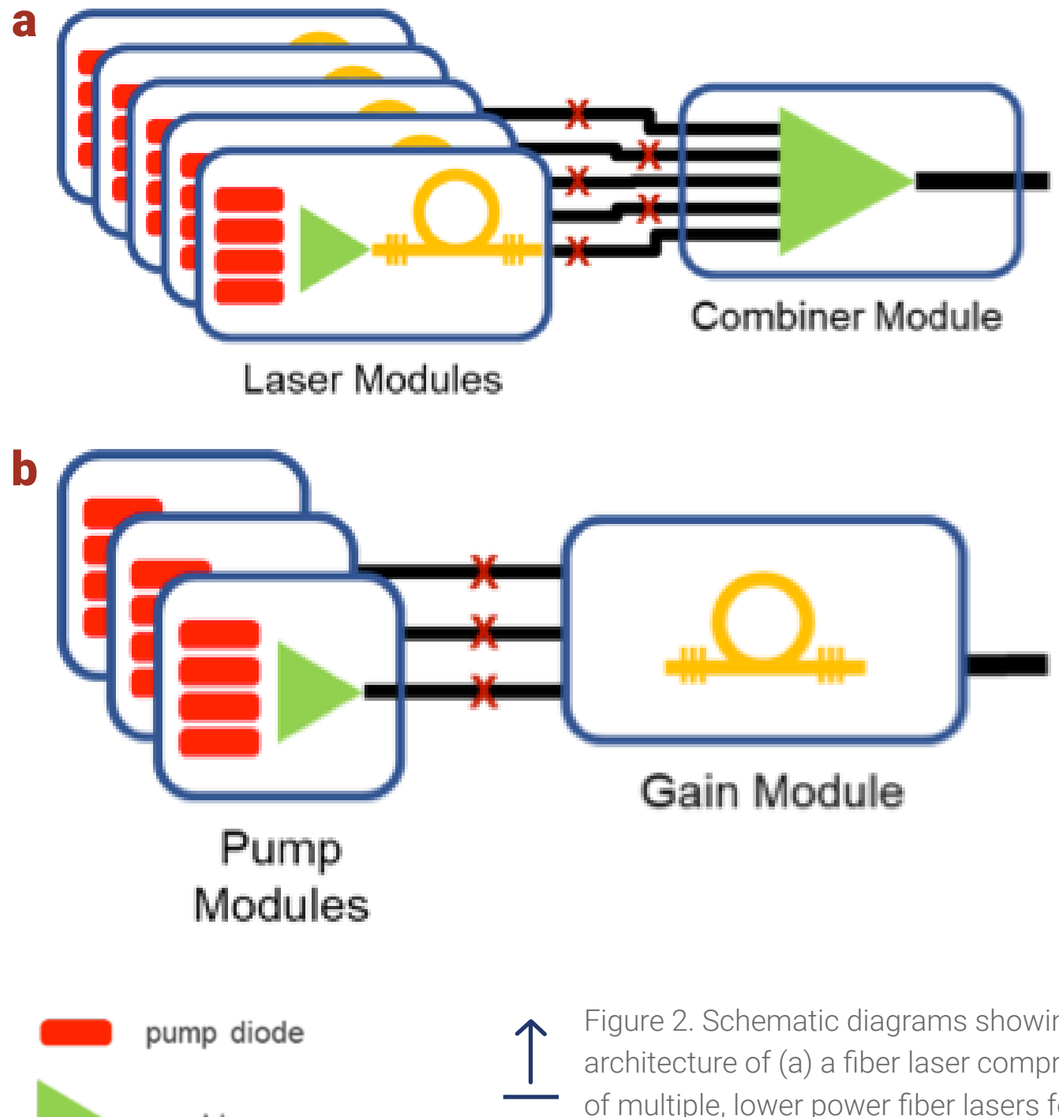
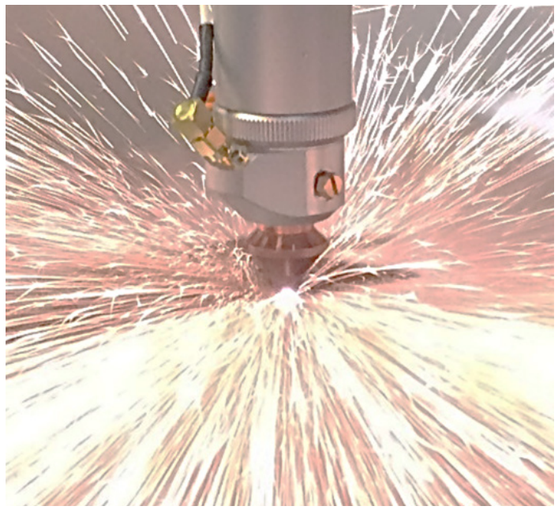


Figure 2. Schematic diagrams showing the architecture of (a) a fiber laser comprised of multiple, lower power fiber lasers for combined output and (b) nLight's next-generation fiber laser. The gain module in (b) is scalable to 4 kW, and two gain modules are combined to provide 6 kW to 8 kW. The distinct approach to modularity shown in (b) provides significant serviceability benefits.

customers, nLight remains available to support or augment the service activities of the integrator, as needed.

As just one example, Cincinnati, Inc., a manufacturer of metal processing equipment, including advanced 2-D laser cutting machines, has been trained to service nLight fiber lasers. The company recently introduced the CL-900 Series fiber laser cutting system, which incorporates nLight's 6-kW and 8-kW fiber lasers.[5] Cincinnati's experience provides an example of the significant advantages of nLight's fiber laser design and service strategy.



Engineers at nLight placed serviceability among its top requirements when designing the company's fiber lasers.

According to Troy Wilson, product line manager at Cincinnati, "Servicing fiber lasers has been much easier than we ever imagined since we started working with nLight. The simple diagnostics, direct communication with the laser system and ability to replace parts within designated non-operational hours lets us keep our customers running 24/7. Providing these unique capabilities to our customers also differentiates us from the competition."

Fiber lasers have enabled tremendous gains in productivity and process capability for sheet metal cutting and other industrial applications. And advances in fiber laser serviceability are further enhancing productivity by maximizing uptime and by ensuring that integrators can provide their customers with seamless service and support. ●

nLight Inc. →

Cincinnati's CL-900 Series fiber laser cutting system incorporates nLight's 6-kW and 8-kW fiber lasers.

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