



**THE POWER TO TRANSFORM<sup>®</sup>**



**HIGH POWER FIBER LASERS  
FOR INDUSTRIAL APPLICATIONS**



## LEADER IN INNOVATION



IPG Photonics World Headquarters, Oxford MA, USA

**IPG Photonics Corporation** is the world leader in high power fiber lasers and amplifiers. Founded in 1990, IPG pioneered the development and commercialization of optical fiber-based lasers for use in a wide range of venues such as materials processing, telecommunications, medical, scientific and other advanced applications. Fiber lasers have revolutionized the industry by delivering superior performance, reliability and usability at a lower total cost of ownership compared with conventional lasers, allowing end users to increase productivity and decrease operating costs. IPG is headquartered in Oxford, Massachusetts with additional manufacturing plants, sales and service offices throughout the world.

manufacture our own process fibers, beam couplers & switches, collimators and chillers. This innovation coupled with our extensive manufacturing capabilities place IPG in the rare position of being in full control of every step needed to achieve this mission: *to deliver innovative, reliable, high quality and high performance fiber lasers at a cost-effective price.*

We are the only company that controls the performance, cost and yield of both active fibers and semiconductor pump diodes - the core technology of our fiber laser and amplifier products. Additionally, we developed and

## HIGH POWER FIBER LASERS

### *A Unique Combination of the Most Advanced Technologies*

High power fiber lasers are created from active optical fibers and semiconductor diodes, a merger between two of the most innovative and advanced laser technologies. Fiber lasers use single emitter semiconductor diodes as the light source to pump the active fibers. The laser beam emitted is contained within optical fibers and delivered through an armored flexible cable. Active fibers, special optical fibers doped with rare earth ions, allow for an extremely bright light from a very small core, thus making possible the production of kilowatt class output with excellent beam quality. IPG uses many proprietary technologies to create the undisputed best beam quality kilowatt class lasers available in the market today.

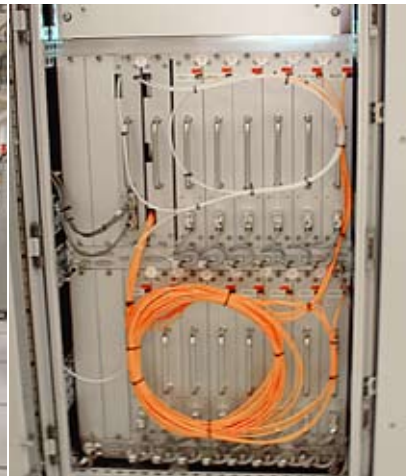
The combination of technologies results in a unique, highly reliable and superior performing laser system with parameters exceeding any traditional laser technology, including disc, rod, YAG or CO<sub>2</sub> lasers. Our robust fiber lasers share common attributes of compact size, long diode life, low maintenance operation, high wall plug efficiency and completely consistent beam divergence and beam profile at all power levels.



IPG's own high-power semiconductor Diodes



Diode burn-in



Open laser chassis displaying the modular design of high power fiber lasers



Post-production fiber lasers

# FIBER LASER ADVANTAGES

## What You Can Expect from an IPG Laser

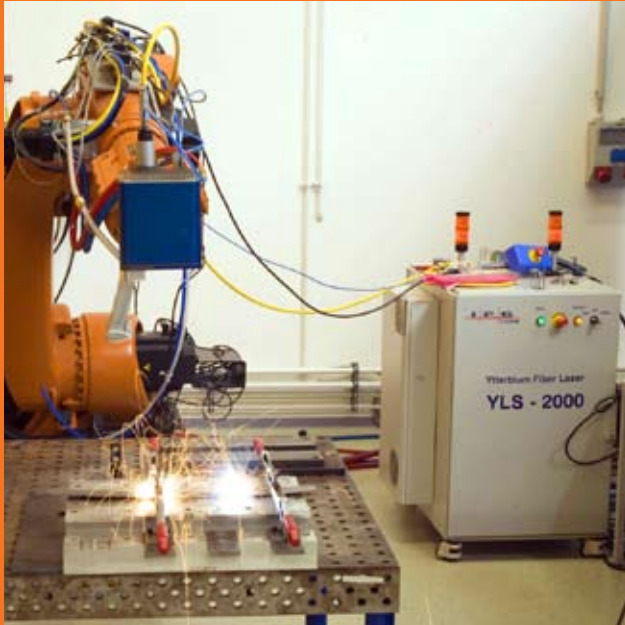
Our low-order-mode kilowatt class fiber lasers range in power from 500 W to 50 kW, operating in CW or modulated modes up to 20 kHz with wall-plug efficiencies greater than 30%. The dynamic operating range of these devices is available from 10% to full power with no change in beam divergence or beam profile throughout the entire range. This allows a single laser to be utilized for both high and low-power applications such as welding, drilling and precision cutting, a previously unheard of capability.

IPG lasers' divergence specifications are far superior than other lasers and allow the use of long focal length processing lenses for vastly improved depth of field, less damage to optical components and are ideal for remote welding applications. The units can be supplied with fiber lengths to 100 meters, different fiber diameters and variety of multi-port beam switches, beam couplers, termination optics and scanners.

Fiber lasers deliver their energy through an integrated flexible optical fiber. Fiber lasers have a monolithic, entirely solid state, fiber-to-fiber design that does not require mirrors or optics to align or adjust. These features make fiber lasers easier to integrate and operate in production, medical and other laser-based systems.

Fiber lasers are typically smaller and lighter in weight than traditional lasers, saving valuable floor space. While conventional lasers can be delicate due to the precise alignment of mirrors, fiber lasers are more rugged and able to perform in variable working environments. These qualities permit fiber laser systems to be transported easily.

The fiber laser is modular, built from multiple laser units, each one generating hundreds of watts of output power. This also allows the laser system to incorporate reserve modules and power margins. Available in the YLS series of high power laser is the redundant module feature. If something should happen with a regular fiber laser module it will shut off and allow the redundant module to start automatically, leaving the laser with no output power loss. An alarm would then be activated notifying the user that a modular requires service but still allowing the laser to operate under normal circumstances.



### MAIN FEATURES

- Excellent Beam Parameter Product (BPP)
- Constant BPP Over Entire Power Range
- Small Focus over Large Working Distance
- Over 30% Wall-Plug Efficiency
- Maintenance Free Operation
- Modular 'Plug & Play' Design
- Compact, Rugged & Easy to Install
- Estimated Diode Lifetime > 100,000 hours
- Integrated Coupler or Beam Switch

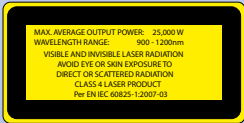


Each classification of high power fiber laser serves a targeted application demographic. With the most compact design, the YLR laser is offered as a cost-effective, adaptable solution for a clean room system or for integration into a production line. Directly terminated to a QBH-type connector with numerous feed fiber lengths and diameters available, the rackmount configuration is ideal for a multitude of applications from cutting, welding and drilling to medical device manufacturing.

With a larger feed fiber core and simple design, the cladding laser (CL) is aptly named. Also utilized for micro and macro welding, brazing, annealing and heat treating applications, the YLS-CL is considered a direct competitor to direct diode systems. With its maintenance-free, robust package the YLS-CL allows for plug and play fiber delivery with interchangeable process fibers available in either square or round diameters up to 1mm.

## YLR Series

## YLS-CL Series



Product Designation*	YLR-XXXX	YLS-XXXX-CL
Description	Rackmount Ytterbium Fiber Laser Module	Cladding Ytterbium Fiber Laser System
Available Operating Modes	CW, QCW, SM	CW, QCW
Polarization	Random	Random
Available Output Power	10 Watts - 1 kW	500 Watts - 2 kW
Emission Wavelength	1070-1080 nm	1070-1080 nm
Feed Fiber Diameter*	Available in single mode, 50,100,200 or 300 μm diameter	300 μm diameter
Wall Plug Efficiency	>30%	>30%
Output Termination Options	QBH-Type (HLC-8). LCA, QD compatible	QBH-Type (HLC-8). LCA, QD compatible
Ancillary Options	Direct feed to termination only	Internal coupler standard, option to upgrade to 1x2 switch
Air Conditioner	Not Available	Available Option
Interface	RS-232, Digital I/O, Analog Control	LaserNet, Analog & Digital I/O interfaces
Cabinet Style/ Dimensions	6U Rackmount Enclosure <sup>1</sup> (HxWxD, mm) 266x448x650	25U Standalone NEMA 12 Enclosure (HxWxD, mm) 1106x856x806
Upgradable	No	No
Redundant Module	Not Available	Not Available

<sup>1</sup> 6U rackmount chassis based on 500 - 1 kW power. <500 Watts housed in either 3U or 4U rackmount design.

The most versatile and customizable option within the product line is the YLS series fiber laser. Developed as a complete system, this design features the widest range of fiber diameters, the option to terminate to up to 6 ports from one power source, and the ability to upgrade. Housed in a NEMA 12, air conditioned sealed cabinet, these systems are designed to operate in industrial manufacturing environments. They have garnered wide acceptance in the very demanding automotive, aerospace and oil and gas industries, many requiring multiple shifts operating.

## YLS Series



YLS-XXXX	YLS-XXXX	YLS-XXXX
Basic kW Ytterbium Fiber Laser System	kW Class Ytterbium Fiber Laser System	kW Class Ytterbium Fiber Laser System
CW, QCW, SM	CW, QCW, SM	CW, QCW, SM
Random	Random	Random
500 Watts - 2 kW	500 Watts - 4 kW	3kW - 10kW
1070-1080 nm	1070-1080 nm	1070-1080 nm
Available in single mode, 50, 100, 200 or 300 μm diameter	Available in single mode, 50, 100, 200 or 300 μm diameter	Available in 100, 200 or 300 μm diameter
>30%	>30%	>30%
QBH-Type (HLC-8). LCA, QD compatible	QBH-Type (HLC-8). LCA, QD compatible	QBH-Type (HLC-8). LCA, QD compatible
Options Available: External coupler, External 1x2, 1x4 or 1x6 beam switch, or External 50:50 beam splitter.	Options Available: Internal coupler, Internal 1x2 beam switch, Internal 50:50 beam splitter, External 1x4 or 1x6 beam switch.	Options Available: Internal coupler, Internal 1x2 beam switch, Internal 50:50 beam splitter, External 1x4 or 1x6 beam switch.
Standard	Standard	Standard
Standard: LaserNet, Digital I/O, Analog Control Additional Options: DeviceNet or Profibus	Standard: LaserNet, Digital I/O, Analog Control Additional Options: DeviceNet or Profibus	Standard: LaserNet, Digital I/O, Analog Control Additional Options: DeviceNet or Profibus
12U Standalone NEMA 12 Enclosure (HxWxD, mm) 558x790x815	25U Standalone NEMA 12 Enclosure (HxWxD, mm) 1106x856x806	31U Standalone NEMA 12 Enclosure (HxWxD, mm) 1400x856x806
Yes, Maximum 2 kW Upgrade	Yes, Maximum 4 kW Upgrade	Yes, Maximum 10 kW Upgrade
Not Available	Available option <3 kW, Standard on 3 kW+	Standard

\*Product designation is relative based on desired wattage and configuration. If a 3 kW system with an internal coupler is desired, the part # designation will be "YLS-3000-CT". Likewise the addition of an internal 1x2 switch will have the "-S2T" or "-S2" notation depending on the location of the switch on the cabinet.  
- Please consult IPG Sales for information regarding >10 kW lasers.

# Optical Coupling, Switching & Sharing

## Maximizing Your Fiber Laser's Capabilities

The ability to couple light from one fiber to another greatly expands upon IPG's fiber laser functionality. A single laser can be used as a power source for multiple work cells thus reducing the total cost of capital equipment. A multi-port unit offers the option of attaching varied process fibers where each work cell could be operating on a different application; for instance one port could weld with a 300  $\mu\text{m}$  diameter fiber in one cell while another port operates with a 100  $\mu\text{m}$  fiber thus providing power to two workstations from a single laser. In addition to greater functionality, optical coupling also provides for ease of replacement of the process fiber, be it for altering the parameters for an application or in an instance of accidental damage to the fiber. If damage does occur, the main power source stays intact and operational for other channels, thus providing greater protection to the power source.



IPG Photonics' 2 way beam switch



A row of IPG Photonics' optical couplers on display

Available options include either a single port coupler, a multi port beam switch offered in either 2, 3, 4, 5 or 6 channels, or a 2 port beam sharing function with the additional option of 100% full power in one port. Each component is available in a multitude of configurations depending on the chosen power source, series and the size of the component. Up to 2 ports can be integrated internally in the YLS series with either top or side mount

depending on the desired end use. External optical ports have the added option of a long stand-off distance for remote installation on the work floor for greater flexibility and convenience. Though the beam sharing function is only available as a 2 port system it can also be combined with the multi-port beam switch for even greater capabilities.

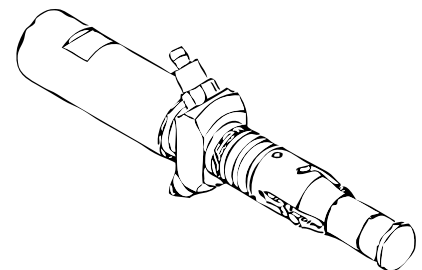
Depending on the power level, feeding fibers are available in either a 50, 100, 200 or 300  $\mu\text{m}$  diameter featuring unbeatable beam quality in comparison with solid-state lasers. The beam can be switched to any channel from any position within 50ms. A state of the art safety system constantly monitors the position of mirrors, fiber interlocks, scattered light inside beam switch cavities, water flow for optical connectors and other important parameters. We manufacture all of our optical couplers, beam switches and beam splitters as well as process fibers. Process fibers are available in 100, 150, 200, 300, 400, 600, 800 or 1,000  $\mu\text{m}$  diameter with lengths up to 100 meters.

## IPG HP Collimators

IPG's line of collimators are available in both D25 and D50 from 60 to 200mm in focal length. The collimators feature water cooled optics, an adjustable focus and are QBH-type HLC-8 adapted for easy connection to any of our feed or process fibers. Available collimators: D25-F60, D25-F85, D50-F100, D50-F120, D50-F160 & D50-F200.



IPG Photonics' D25-F60 & D-50-F160 Collimators



IPG Photonics' HLC-8 Connector

## Laser Control Software *Interface Options and Abilities*

IPG fiber lasers feature the most up to date control functions requested by the industry. Interfaces such as Profibus, DeviceNet, Industrial Ethernet or simple digital I/O make integration with complex equipment straightforward and easy to use. All laser parameters and available peripherals such as a multi-channel beam switch, chiller, guide laser, power supply, etc. are constantly monitored and controlled by an internal computer and can be remotely accessed at any time. A convenient graphical user interface can be installed on any customer PC. In addition, IPG's fiber lasers have conventional interfaces such as analog control and direct modulation. Response time to these signals is less than 50 microseconds which is crucial for applications with on-the-fly adjustments. Moreover, the laser can store up to 50 different programs with 100 commands each which can be called out with the simple push of a button or via external digital signal.

## Customer Care *Fast and Professional*

Unlike conventional laser technologies, IPG fiber lasers require no preventive maintenance. As long as output optics and coolant are properly maintained by the customer, the laser will perform consistently without adjustment or intervention by the customer or IPG. This greatly reduces downtime and maintenance cost to the customer. We have a team of dedicated service professionals and technical support specialists worldwide to provide personal and effective customer support.

## Applications Processing Centers

### *Developing Your Laser Solution*

IPG Photonics offers free applications development through any of our six Materials Processing Centers worldwide. With three US locations: Santa Clara CA, Novi MI, and Oxford MA, as well as 3 international locals: Burbach Germany, Moscow Russia and Beijing China, our applications developers are there to provide customers with an opportunity to evaluate fiber laser technology for materials processing. We offer prototyping and feasibility studies to our prospective customers to evaluate fiber lasers for their unique applications. Our knowledge of fiber laser applications can accelerate and improve your application development, from macro machining to micro machining and marking of various materials. Each of our applications labs offers our customers proof of concept, process development, recommendations, consultations, optical metrology, metallurgy, sample processing and an accompanying full results report.



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