Industrial Fiber Lasers for Materials Processing
from the World Leader in Fiber Lasers

PRODUCT GUIDE

www.ipgphotonics.com
This mission is best exemplified by the flagship YLS High Power Ytterbium fiber laser series featuring power options from 1 to over 100 kW, industry leading wall plug efficiency up to 50% and reliability for use in high duty 24/7 applications. A variety of beam divergence and intensity profile options and availability of high QCW peak power allow flexible use of a single laser for applications requiring both high and low beam brightness and power, such as high power cutting, precision cutting, welding, cladding and drilling. The superior divergence of IPG fiber lasers also make them ideal for remote applications.

Fiber lasers have an end-to-end solid state monolithic design without free space precision optics sensitive to alignment or contamination. Unlike conventional lasers, IPG fiber lasers are rugged, easy to transport and install, excelling in the harshest industrial working environments. IPG lasers are smaller and lighter than traditional lasers and with wall plug efficiencies exceeding any competing technology. The unique combination of industry leading power, reliability, compactness, energy efficiency, flexible beam delivery and ease of integration have made IPG fiber lasers the global tool of choice in industrial materials processing.

IPG Photonics is headquartered in Oxford, Massachusetts with additional manufacturing plants, sales, application development and service offices throughout the world.
The YLS fiber laser, with output powers up to 120 kW, was developed as a complete system for industrial applications. It has garnered wide acceptance in the very demanding automotive, aerospace and oil and gas industries. All YLS systems are housed in a NEMA 12, air-conditioned and sealed cabinet adding to the robustness of the unit. These systems are controlled by either digital I/O, analog control or IPG LaserNet software with the additional option to add either DeviceNet, Profibus or Ethernet interfaces. This design features the widest range of fiber diameters, as well as the option to terminate to up to 6 ports from one power source.

The YLS series is developed specifically for applications where space is a premium. YLS-U lasers provide up to 10 kW average power in the smallest form factor available on the market. Having full featured interfaces and safety electronics of the new generation IPG fiber lasers, the YLS-U design is cost/performance optimized and can be easily integrated within cutting machines. Internal dehumidifier enables the laser to be used in the harshest of production environments.

Adjustable Mode Beam (AMB) capability on the flagship YLS family of lasers allows customers to change the output beam mode on-the-fly and increase flexibility in cutting and welding applications. AMB enables programmable adjustment of the output beam mode to any combination of a small-spot high intensity bright core to a larger ring-shaped beam. AMB allows processing a wider range of material thicknesses and improves welding and cutting quality and speed.

On-the-Beam Mode Tunability

Widest Range of Applications

Process a Variety of Materials

Improve Process Quality

The low order mode YLS fiber lasers operate in CW(modulated modes up to 5 kHz with wall plug efficiencies >40%). The wide dynamic power range with no change in beam divergence or beam profile allows a single laser to be used for both high and low-power applications such as welding, drilling, and cutting, a previously unheard of capability. The high brightness allows the use of small focal length processing lenses for vastly improved depth of field and minimal damage to optical components. The units can be supplied with fiber lengths up to 100 meters, different fiber diameters and variety of multi-port beam switches, beam couplers, termination optics and scanners. The options determine the laser part number and informs cabinet size.
The QCW capability provides peak powers up to 2X average power, allowing increases in speed, improved piercing quality and piercing of thicker materials. The reduced heat input in the 2X Peak-Power mode results in higher quality cuts of intricate parts along with cleaner and more controlled drilling of thicker materials. This unique capability is made possible by unique IPG QCW diode designs, which have the ability to provide very high peak power for short duty cycles. Available exclusively from IPG in the latest releases of YLR and YLS lasers, the QCW 2X Peak Power mode is developed to increase the overall throughput, while saving material, time and operating costs.

**New QCW Option on High Power Lasers**

**2X Peak Power Boost in Pulsed Mode**

The QCW capability provides peak powers up to 2X average power, allowing increases in speed, improved piercing quality and piercing of thicker materials. The reduced heat input in the 2X Peak-Power mode results in higher quality cuts of intricate parts along with cleaner and more controlled drilling of thicker materials.

- Reduced Heat Input
- Higher Quality Cuts of Fine Features
- Higher Piercing Quality
- Shorter Piercing Time
- Piercing of Thicker Materials
- Enhanced Welding and Drilling Capabilities

The YLR Series Ytterbium Fiber Lasers offers a unique combination of output powers (10 Watt to 3 kW), ideal beam quality (single-mode or multi-mode), flexible fiber delivery and high wall plug efficiency in near infrared spectral range (1010-1070 nm). The 19” rack mountable units are a cost-effective, adaptable solution for a clean room system or for integration into a production line. With a rear control via Analog, RS-232 or Ethernet interfaces and an optional front panel touch-screen display, the rack mount configuration is ideal for a multitude of applications such as cutting, welding, drilling and additive manufacturing. The YLR Series features water-cooled (WC) models with output powers up to 3 kW and air-cooled (AC) models up to 700 Watts. External D12.5 delivery optics, collimators and a variety of process heads are available.

**Rack Mount Unit Dimensions**

All rack mountable units have a width of 448 mm. Unit heights are 133 mm (3RU), 177 (4RU) and 266 mm (6RU).

**Applications**

- Cutting
- Drilling
- Soldering
- Welding
- 3D Printing/Sintering
- Over 40% Wall Plug Efficiency
- Industry Leading Diode Lifetime
- Pulse Modulation
- Plug-and-Play Design
- Multi-port Options
- Compact, Rugged & Efficient

**YLR Series**

**Rack Mounted CW Ytterbium Fiber Lasers**

- Efficiency
  - Over 40% Wall Plug Efficiency
- Capabilities
  - Pulse Modulation
  - Plug-and-Play Design
  - Multi-port Options
  - Compact, Rugged & Efficient

**YLR-MM multi-mode lasers are equipped with a standard 50 μm feeding fiber to an HLC-8 connector. Additional options include 100 or 200 μm diameters to an HLC-8 connector or 50, 100 or 200 μm to an affixed collimator. Available focal lengths: 20, 38 or 53 mm.**

**Single-mode YLR models with a 5 mm diameter beam are equipped with an affixed collimator for powers up to 400 Watts; 500-1,500 Watt lasers terminate to an HLC-8 connector. Interchangeable collimators and processing heads connect easily to the HLC-8, options listed on page 9. Affixed collimator options include beam diameters in either 2.5 or 7.5 mm.**

**ELR and TLR Series**

**Rack Mounted CW Erbium and Thulium Fiber Lasers**

- Non-metal Materials Processing
- Plastics Cutting and Welding
- Polymer Marking

**Applications**

- Cutting
- Drilling
- Soldering
- Welding
- 3D Printing/Sintering

**Lasers Series**

<table>
<thead>
<tr>
<th>Wavelength Range, μm</th>
<th>ELR Erbium Fiber Lasers</th>
<th>TLR Thulium Fiber Lasers</th>
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<tr>
<td>1.53-1.57 μm</td>
<td>100 W Single-mode</td>
<td>200 W Single-mode</td>
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<tr>
<td>1.9-2.05 μm</td>
<td>150 W Multi-mode</td>
<td>500 W Multi-mode</td>
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**The Power to Transform®**

**YLR-MMM**

- Cutting
- Drilling
- Soldering
- Welding
- Enhanced Piercing Quality
- Piercing of Thicker Materials
- Enhanced Welding and Drilling Capabilities

**ELR and TLR Series**

- Non-metal Materials Processing
- Plastics Cutting and Welding
- Polymer Marking

**Applications**

- Cutting
- Drilling
- Soldering
- Welding
- 3D Printing/Sintering

**Laser Series**

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The ELR Erbium fiber lasers operate in the 1530-1570 nm “eye-safe” wavelength range with output powers up to 150 Watts. The TLR Thulium fiber lasers operate in the 1900-2050 nm wavelength range, offering output powers up to 500 Watts. These lasers have typical industrial applications in plastics/polymer cutting, welding and marking. They are also used in various scientific, advanced and medical applications including telecom, IR pumping, remote sensing, surgery and dermatology.

Air- and water-cooled modules are also available at selected power levels for OEM integrators.
**QCW SERIES**

**Quasi-CW Ytterbium Fiber Lasers**

**Applications**
- Cutting
- Drilling
- Welding
- Metal Engraving
- Non-metal Processing
- Micromachining

**Efficiency**
- Over 30% Wall Plug Efficiency
- Industry Leading Diode Lifetime

**Capabilities**
- Long Pulse Operation
- Plug-and-Play Design
- Maintenance-Free Design

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**Air-cooled Fiber Laser**

- QCW Fiber lasers provide multiple Joules of pulse energy at multi-kW peak powers with μs to ms pulse duration. They are ideally suited for industrial applications requiring a high peak power and pulse energy in a long pulse regime, such as welding, seam welding and drilling. Designed to displace legacy YAG lasers due to their minimal maintenance costs and low upfront costs, QCW lasers are easily retrofitted into most existing systems.

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<td>50, 100 or 200 μm</td>
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<td>50, 100 or 200 μm</td>
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<td>YLS-900/9000-QCW-AC</td>
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<td>9000</td>
<td>90</td>
<td>100, 200 or 300 μm</td>
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**The Power to Transform®**

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**YLPS SERIES**

**Pulsed Fiber Lasers**

**Applications**
- Marking & Engraving
- Precision Texturing & Ablation
- Selective Material Removal
- Micro Cutting, Scribing & Hole Drilling

**Capabilities**
- Optimization of Both Job Quality & Throughput
- Micromachining Virtually Any Type of Material
- Ultimate Flexibility in Choosing Operating Parameters

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**PULSED FIBER LASERS FOR SURFACE TREATMENT**

IPG high-power nanosecond fiber lasers are available in powers from 500 W to 5 kW, pulse durations from 100 to 500 ns and pulse energies up to 100 mJ with pulse repetition rates up to 1.5 kHz. They are ideal for applications in micromachining, photovoltaics, via hole drilling, resistor trimming, wafer scribing and dicing, specialty black marking of stainless steel and aluminum and marking of transparent materials.

**Applications**
- Paint Stripping, Surface Cleaning
- Surface Texturing, Heat Treating
- Surface Preparation & Treatment
- Large Area High Throughput Ablation

**Capabilities**
- Optimization of Both Job Quality & Throughput
- Ultimate Flexibility in Choosing Operating Parameters
- Large Range of Materials

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**NEW**

**YLPS-50-120-5000-S: MEGAPULSE YTTERBIUM LASER**

The new high power, pulsed fiber laser provides an average output power up to 50 W, a pulse duration <500 fs at full operational repetition rate of 50-2000 kHz. The excellent beam quality, ultrashort pulse duration and high pulse energy combine to provide peak power densities suitable for micromachining virtually any material: metal, glass, ceramics, silicon and plastics.
GLPN lasers with three-pulse burst capability are ideally suited for micromachining applications. Our Prism Award winning high repetition rate VLM and VL green lasers provide unrivaled performance with output power up to 500 Watts with single-mode beam quality, ease of use and high reliability at a lower cost, enabling new applications and accelerating customer ROI.

IPG develops and manufactures a wide range of green fiber lasers from CW to ultra-short pulse duration. IPG green fiber lasers serve diverse materials processing markets such as medical device manufacturing, solar, semiconductor, electronics and mass consumer product manufacturing. The GLPN lasers with three-pulse burst capability are ideally suited for applications requiring different brightness and spot sizes. Standard utilization of these lasers is through a permanently built in feeding fiber of a determined core diameter; the diameter of the feeding fiber places the limit on the maximum brightness provided by the laser. In some instances, particularly when a laser is dedicated to a single work cell, the feeding fiber can be connected directly to a process head or a collimator. However, when a high power kW class laser is used, the user can further customize the build of the system, due to the flexibility of the laser. Such customizations include increasing the number of output ports through beam splitting or switching or simply increasing the versatility of a single port through optical coupling or shutting the beam.

**PROCESSING FIBERS**

Process fibers of various lengths and core diameters are fitted with a range of connectors. The fibers are available in 100, 150, 200, 300, 400, 600, 800, and 1,000 μm diameters with lengths up to 100 meters. The process fibers are available with either industry standard connectors (HLC-8, LCA) or with IPG exclusive high-power connectors (HLC-16, HLC-24) which can handle output powers up to 100 kW.

IPG also manufactures its own line of collimators. These collimators are available from 50 to 200 mm focal length in D25, D30 and D50 packages. The collimators are available with either water-cooled or air-cooled optics, an adjustable focus and with standard utilization of single-channel types for easy connection to any of our fiber or process fibers.

Process fibers are the link from the beam switch or coupler to a process head or collimator. However, when a high power kW class laser is used, the user can further customize the build of the system, due to the flexibility of the laser. Such customizations include increasing the number of output ports through beam splitting or switching or simply increasing the versatility of a single port through optical coupling or shutting the beam.

**TIME AND ENERGY SHARING**

The ability to couple light from one fiber to one or more process fibers greatly expands upon fiber laser functionality. While a feeding fiber is a connection directly from the laser source, process fibers are the link from the beam switch or coupler to the processing head or collimator. Process fibers are essential for industries that benefit from multiple workstations or multi-application processing. They also provide the option for a long stand-off distance from the laser to the process area for manufacturing space flexibility. They are interchangeable in field with minimal effort without an IPG technician. This allows the user to be able to change between different diameter and length fibers to suit changing applications as well as decrease down-time risk if, on the odd chance, any damage were to happen to the fiber.

**FIBER BEAM DELIVERY**

Flexible Beam Delivery

IPG offers beam couplers, switches, shearsers, and shutters in D12.5, D25, D50 and D85 sizes. Beam switches are offered with 2, 3, 4 or 6 output ports with customized options for energy switching or/for timesharing as well output connection type (HLC-R, HLC-16, HLC-24 or LCA). All switches or couplers require the use of a step-indexed process fiber to connect the laser source to the process head or collimator, this greater increases the versatility of the laser.

All delivery optics are designed and manufactured by IPG and are tailored specifically for fiber lasers.
### PROCESSING HEADS
Cutting & Welding Heads for Fiber Lasers

#### Cutting Heads

<table>
<thead>
<tr>
<th>FLW-D30</th>
<th>FLW-D50-L/5/HP</th>
<th>FLW-D85-HP</th>
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</thead>
<tbody>
<tr>
<td>Micro</td>
<td>Compact</td>
<td>FLC-D30</td>
</tr>
<tr>
<td>Up to 6 kW</td>
<td>Up to 10/30/50 kW</td>
<td>Up to 100 kW</td>
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</tbody>
</table>

IPG cutting heads are designed to provide the highest laser power handling capability in the industry in a completely sealed and lightweight package; increasing optics lifetimes, preventing gas leakages and providing easy optics service access. These heads come with the widest selection of collimator and focusing optics as well as additional accessories and optional features.

#### Welding Heads

<table>
<thead>
<tr>
<th>FLW-D30-W</th>
<th>FLW-D50-W</th>
<th>FLW-D85-W</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPGcut-D30</td>
<td>Up to 6 kW</td>
<td>Up to 12 kW</td>
</tr>
<tr>
<td>IPGcut-D50</td>
<td>Up to 12 kW</td>
<td>30 kW +</td>
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</table>

IPG welding heads are designed to deliver the highest amounts of power in a compact and cost-effective package. They are offered in a range of models that have various powers levels as well as numerous features and accessories to fit specific application needs.

#### Wobble Heads

<table>
<thead>
<tr>
<th>FLW-D30-W</th>
<th>FLW-D50-W</th>
<th>FLW-D85-W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 6 kW</td>
<td>Up to 12 kW</td>
<td>30 kW +</td>
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</table>

IPG offers welding heads with Beam Wobbler capability which broaden weld seams and provide high-quality welds even in the presence of a gap. Available in multiple configurations with the broadest focus and collimator lens options, the wobblers are the ultimate tool to weld a multitude of different material types and thicknesses.

#### Cladding Head

<table>
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<tr>
<th>IPGClad-D50</th>
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<tbody>
<tr>
<td>Up to 10 kW</td>
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</table>

IPG Cladding Heads are designed to provide various deposition rates at various laser powers with integrated Fraunhofer Coax II Powder Nozzle in a completely sealed package. They are the ultimate tool to clad a multitude of different material types at high deposition rates for additive manufacturing applications.

### Welding/Wobbler Accessories

IPG offers many options for customizing your application needs through modules for seam tracking, wire feeding, beam spot shaping, dual beam spot creation and a comprehensive, real-time weld monitoring system as well as cameras, gas assists and air knives.

#### Inline Weld Monitoring

**LDD Weld Depth Monitoring System** offers five monitoring modes: keyhole depth, seam profile, workpiece height, finished weld surface height, and bead profile— all in real-time from a single instrument.

**Dual Spot Module** – 50/50 power distribution with beam separation in the X or Y direction. **Beam Shaper** – available in 6x6 mm square and 6 mm diameter circular outputs. **WHAM (Welding Head Alarm Monitor)** monitors cover slide window presence, contamination and temperature. **Wire Feeder Module** — enables integration of commercially available wire feeders with IPG welding heads.

### Integrated Marker Modules

IPG brings ease and flexibility to laser marking integrators and OEMs by providing complete laser marking modules in a single compact and cost-effective package. The modules include control electronics, scanning optics and versatile marking software.

#### Scanners

**IR Integrated** | **Green Integrated** | **UV Integrated** | **Picosecond Integrated**

The scanners are offered with laser power handling of up to 12 kW to optimize applications such as remote welding, remote cutting, and surface cleaning/treatment.

IPG remote laser processing products range from Mid-Power scanners to 2D & 3D High-Power scanning systems. IPG Remote Welding heads integrate seamlessly to IPG Lasers, offer the highest power handling in the industry and utilize a compact and lightweight architecture ideal for integration with a robot or gantry.
COMPREHENSIVE SERVICES
What you can expect from IPG Photonics

Premium Warranty & Support

IPG stands behind our commitment to our customers with the best warranty in the industry. All IPG lasers listed in this brochure are warranted against defects in materials and workmanship, under normal use, for minimum two years; three years for the YLS family of lasers with extended warranties available up to ten years.

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 costs to the customer. We have a team of dedicated service professionals and technical support specialists worldwide to provide personal and effective customer support.

Extensive Laser Solution Development

IPG Photonics offers free applications development through any of our Materials Processing Centers worldwide. 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.

Applications Centers Worldwide

<table>
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<th>Country</th>
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<th>Lab Focus</th>
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The Power to Transform®
IPG Photonics manufactures a wide range of laser products with laser classifications ranging from Class I to Class IV. Please review the individual product specification for the optical performance characteristics specific to the device. This information typically includes the wavelength range, output power (CW and/or Peak), Pulse Energy, Pulse Repetition Rate, Pulse Width, etc.