redENERGY® G4
Pulsed Fiber Laser
Versatility for Industry

Automotive
2D/3D Cutting | Night & Day Marking | Sub 2mm Metal Cutting | Welding

Electronics
Battery Technology | Chip Resistors | Drilling | Engraving | IC Marking | Marking Plastic & Metal | Semi-Conductor Marking

Medical
Fine Wire Welding | Medical Devices | Metallic Marking | Plastic Welding | Precision Cutting | Precision Welding | Stent Cutting

Advanced Manufacturing
Micro-Machining | Additive Manufacturing | 3D Printing

Solar
Ceramic Cutting | Ceramic Marking | Ceramic Scribing | Solar Scribing | Thin Film Patterning | Thin Film Processing

Aerospace
Welding Turbine Components | Thermal Barrier Coating Removal | Drilling Super Alloy | Drilling and Cutting Combustor Liners and Cans
Versatility for Industry

**Batteries**
- Welding
- Scribing
- Cutting Thin Battery Foil

**Jewellery**
- Silver Marking
- Gold Marking
- Silver Cutting
- Gold Cutting
- Hallmarking
- Engraving Silver and Gold

**Dental**
- Ceramic Engraving
- Metallic Marking

**Scientific**
- Clinical study
- Metrology
- Spectroscopy

**Printing**
- QR Code Marking
- Food and Beverage Packaging
- Marking Consumer Goods
- Fast raster scanning and marking ‘on the fly’

**Sensors**
- Gas detection
- Environmental monitoring
- Hermetic packaging
Marking

• Permanent marks
  • Full life traceability

• Non-contact process
  • No wearing of parts
  • Minimal fixturing requirements
Marking

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- **Versatile application**
  - Wide range of materials
  - Computer generated marks
  - Part by part serialisation
  - No tooling changes
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- Versatile application
  - Wide range of materials
  - Computer generated marks
  - Part by part serialisation
  - No tooling changes

- High speed, high precision
  - 1,000+ characters per second
  - Mark features of <20 µm possible
  - Positional accuracy of a few microns

Day / Night Marking on ABS Plastic
Cutting

• High levels of accuracy and repeatability
  • Even on reflective metals!

• Faster than traditional techniques
  • Foil cutting at >1m/s
  • No need for costly tooling changes
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- Able to cut thicker materials
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• Energy efficient
  • Reducing waste and environmental impact
Welding

- High quality micro-welding
  - Extremely low levels of thermal distortion
  - High levels of consistency
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• Dissimilar metal joining
  • Cannot be achieved with a CW laser
  • Able to join even the most ‘difficult’ combinations
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- Joins are fast accurate
  - Process can be completed in seconds
Drilling & Micromachining

- Small feature sizes
  - Able to drill holes with <40μm diameter
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  - Intricate shapes can be created
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- **Various types of drilling across materials**
  - Metals
  - Crack free drilling of ceramic

Drilling Aluminium Oxide
Engraving

- High quality light and deep engraving
  - Fine features and low taper angles
  - Greater control on the depth of engraving
  - Polishing with $R_a$ down to 1 um
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  • Removal rates of > 50 mm$^3$/min
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- Wide range of materials
  - All metals
  - Industrial ceramics
  - Stone

Engraving Coated Aluminium
Ablation & Cleaning

- Cost effective and environmentally friendly
  - No solvents or chemicals are required
Ablation & Cleaning

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- **Higher quality ablation**
  - Minimal heating of the work piece

ITO Thin Film Removal

43.1 µm
Ablation & Cleaning

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- **Higher quality ablation**
  - Minimal heating of the work piece

- **Increased precision and processing speed**
  - Enabling both fine detail and large area coverage
  - Controllable level of abrasion

- **Non-contact process**
  - No wearing parts
  - Minimal fixturing requirements

Cleaning Rust on Mild Steel
• Improving on existing processes
• Finding solutions for new applications
• Establishing applications ‘know how’
• Providing Customer Training Classes
• Customer specific case studies
• Centers in the UK, USA and China

Visit [www.spilasers.com](http://www.spilasers.com) for more information on our applications capabilities and to see our library of ‘Applications Postcards’ and ‘Insights’
The market leading Fiber Laser platform...

redENERGY®

G4
Features of redENERGY G4

- **Wavelength**
  - 1060nm across the range

- **Average Power**
  - From 20W to 200W

- **Pulse Energy**
  - Up to 5mJ

- **Pulse Duration**
  - 3ns – 2000ns

- **Peak Power**
  - Greater than 40kW

- **Pulse Repetition Frequency**
  - From 1kHz to 4MHz

- **CW mode**
  - With modulation to 100kHz

- **Visible pilot laser**
Benefits of redENERGY G4

- **Compact**
  - Smaller footprint than other laser sources

- **Comprehensive portfolio**
  - Servicing a wide range of applications

- **Flexible cooling options**
  - Air and water cooling available

- **Monolithic design**
  - No need to clean optical surfaces

- **No routine maintenance required**
  - No optical realignment or pump replacement

- **Highly efficient**
  - Up to 30% wall-plug efficiency
Benefits of redENERGY G4

- **Flexible beam delivery**
  - Range of cable lengths and beam diameters

- **Robust beam delivery cable**
  - IP54 rated

- **Field replaceable output optics**

- **Field replaceable electronics**
  - Reducing cost of failure

- **Industry leading reliability**

- **3 year industry leading warranty**
  - 1+ year(s) more than the competition

- **CE Marked**
Benefits of redENERGY G4

- **Mixed mode operation**
  - Hardware and software + mixed HW/SW modes

- **Ethernet connectivity**
  - With diagnostic GUI and network control

- **First pulse equalisation**
  - With simmer and just in time pumping
• SPI’s pulsed product range benefits from a Master-Oscillator Power-Amplifier (MOPA) design

• The MOPA arrangement, when combined with SPI’s sophisticated PulseTune control electronics, enables the laser to generate a range of temporal pulse shapes, which are known as Waveforms
• PulseTune allows for control over pulse duration, energy and peak power through the use of predefined waveforms

• This, in turn, provides greater process control and flexibility, leading to improved quality, productivity and added value

PulseTune = Higher Quality + Greater Flexibility + Increased Productivity = Improved Profitability
PulseTune Options

• The G4 Pulsed Fiber Laser product range offers 3 PulseTune performance options...

RM Series (Reduced Mode)
• Models benefit from 2 PulseTune waveforms and pulse repetition frequency up to 500 kHz

HS Series (High Specification)
• Pulse width variable (25 pre-set waveforms)
• Enhanced control and modulated CW functionality
• Up to 1 MHz pulse repetition frequency

EP Series (Extended Performance)
• Up to 40 optimised PulseTune waveforms
• Most versatile Fiber Laser source
• Increased pulse energy and peak power
• Pulse width range of 3 - 2000 ns
• Up to 4 MHz pulse repetition frequency
Flexibility and Productivity

- PulseTune technology gives users greater control of pulse conditions, providing the ability to maintain high peak power with increasing pulse repetition frequencies up to 4MHz.

- Higher pulse repetition frequency allows cleaner mark edges and faster processing speeds.
Beam Quality Options

**S Type - Single mode (M² <1.3)**
- Generating very fine spot size <20 microns with high power stability and large depth of focus.

**Z Type - (M² <1.6)**
- Offering higher peak power and pulse energy with only minor increase in spot size with good depth of focus.

**L Type - ‘Low’ mode (M² 1.6 - 2.0)**
- General marking applications giving slightly larger spots and features that are visible to the naked eye.

**H Type - ‘High’ mode (M² 2.5 - 3.5)**
- Offering higher pulse energies, peak powers and even larger spots for wide lines and large area coverage

**M Type - ‘Multimode’ (M² 4.0 – 6.0)**
- Highest pulse energies and longer pulse durations ideal for welding and cleaning.
### The redENERGY G4 Product Range

#### BEAM QUALITY

<table>
<thead>
<tr>
<th></th>
<th>S Type (M²&lt;1.3)</th>
<th>Z Type (M²&lt;1.6)</th>
<th>L Type (M²&lt;1.6-2.0)</th>
<th>H Type (M²&lt;2.5-3.5)</th>
<th>M Type (M²&lt;4.0-6.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Energy Peak power</td>
<td>&lt;0.7 mJ &gt;7 kW</td>
<td>&lt;1.5 mJ &gt;10 kW</td>
<td>&lt;0.8 mJ &gt;12 kW</td>
<td>&lt;1.25 mJ &gt;20 kW</td>
<td>&lt;5 mJ &gt;40 kW</td>
</tr>
</tbody>
</table>

#### PULSETUNE (pulse duration)

<table>
<thead>
<tr>
<th>Waveforms</th>
<th>RM 2 waveforms (25-250ns)</th>
<th>HS 24+ waveforms (10-250ns)</th>
<th>EP 40+ waveforms (3-2000ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20W / 50W</td>
<td>-</td>
<td>20W</td>
</tr>
<tr>
<td></td>
<td>20W / 30W / 50W / 70W</td>
<td>20W</td>
<td>40W / 70W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20W / 50W / 70W / 100W / 130W / 200W</td>
<td>130W / 200W</td>
</tr>
</tbody>
</table>

#### Key Attributes

- Fine features <25um
- 25um – 60um
- Multi purpose 35um – 80um
- Wider lines >60m
- High pulse energy & peak power

#### Apps

- Scribing / Fine marking
- Marking / Engraving / Cutting
- Plastic / metal marking
- Wide marks / Deep engrave
- Cleaning / polishing / welding

All redENERGY G4 Fiber Lasers are OEM devices for incorporation

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VERSATILITY COMES AS STANDARD...

From marking to micro machining, welding to additive manufacturing, engraving and cutting. Our range of Pulsed and CW Fiber Lasers are the most versatile beam sources in the industry.

To find out how our versatile Fiber Lasers can benefit you, visit: www.spilasers.com