A DIVISION OF FONON TECHNOLOGY INTERNATIONAL

Handheld

FIBER LASER MARKING SYSTEM
The standard configuration of the **Handheld** marking system allows for many different options to meet any production need. This extremely versatile unit can be moved easily for convenient operation to any location and is capable of marking materials ranging in size from miniscule to considerably large equipment that would not fit into traditional marking systems.

Due to the increasingly worldwide nature and importance of the optics/electro-optics industry, detector/sensors industry, components industry and materials industry, the United States Government and Home Land Security initiated a variety of programs where lasers became an essential part of present and future defense applications. In the private sector, a variety of government contractors elected to use lasers and advanced optics to comply with strict government regulations. Laser Photonics envisioned the opportunity and successfully introduced and delivered solutions compatible with military standards, while continuing to perfect the use of our laser technology for future commercial and defense applications.

**No PC Required**

With a built-in DSP module system. The Handheld will operate without a PC. In this case, the marking pattern is saved on the multimedia memory card or uploaded into the system from any stand alone PC or laptop. On board computers with 32 Mb media flash memory cards store marking and lasing files. The system connects to a stand alone PC or laptop via standard USB cable. After files are uploaded, the computer may be disconnected from the laser system.

**Optional Configuration Includes:**

- 19” rack, 2U industrial PC-based controller, open configuration, field upgradable with DSP ISA card, opto-isolated and signal converter and marking/laser control software installed
- I/O extension board (optically isolated 7 input and 5 output ports)
- Remote control interface for all components
- Pointing laser diode

Many applications require permanent identification marking of parts to meet the requirements of government and assembly manufacturers. Identification codes need to resist all manors of caustic substances and environments while remaining in a state suitable for finishing operations.

**Q-Switched Fiber Lasers**

The revolutionary LPQ Series, maintenance-free and Q-switched pulsed Ytterbium/Erbium Fiber Lasers are safe and easy to use with the lowest operating cost available. They feature independent components including a Q-switched fiber laser, scanning head, PC based controller, power supply, and software with optimal configuration.
These lasers deliver a high power 1.07μm laser beam directly to the work site via a flexible metal-sheathed single mode fiber cable. The integrated solution relieves customers of laser handling and alignment, thermal management and maintenance challenges. Collimated and then typically focused to a spot size of a few microns or less, the near diffraction-limited beam can mark precisely and efficiently on a variety of materials.

The LPQ Series provides a wide variety of pulse durations, repetition rates and peak powers. The fiber based design and rugged metal case allow these compact laser modules to operate under industrial shock, vibration, dust and humidity within the temperature range of 0° to 50°C. This system and all components are highly reliable and designed for predictable, low cost service cycles which are ideally suited for demanding industrial environments.

**Standard Features**

- Digital control eliminates analog noise; stable operation in most rough environments
- 10 to 80 or 20 to 100kHz tunable repetition rate (depending on the laser module)
- Fiber delivery - fiber outputs with integrated beam expander and optical isolator
- Extremely lightweight and equipped with a handle for increased portability
- Up to 2mJ energy per pulse; enough for deep engraving on hard materials
- Operates with 110 Volts standard plug or 12 volts DC from car battery
- Q-Switched Fiber Laser with pulse energy 80 to 500ns pulse duration
- Double Fast™ Digital Scanning Head with 7 or 10 mm aperture
- i-Series Fiber Lasers integrated with scan head power supply
- Maintenance-free operation - 50,000 to 100,000 hours MTBF
- F-Theta objective lenses with 100 mm focal length
- Laser draws only 250 watt (less than a computer)
- Custom OEM specifications available
- 1060 - 1070 nm wavelength
- Excellent beam quality (M2 < 1.05)
- Mounting hardware and cables
- Up to 50% wall-plug efficiency
- Flash memory for lasing files
- 3 meter optical fiber cable
- FiberScan C3™ software
- 2 year warranty on laser
- No alignment required
- Viewing safety window
- Mini exhaust ventilator
- Air cooled
Applications

• Common applications: alphanumerics, UID, serial numbers, part numbers, schematics, complex graphics, pictures, logos etching (material vaporization)
• Direct parts marking, barcoding, 2D data matrix codes, lot codes, date codes
• Layer by layer dark paint removal for radio buttons and backlit panels
• OCR code marking (human and machine readable)
• Paint removal from plastic surfaces
• Production line integration
• 2D Symbologies linear barcodes
• IC chip package marking
• Surface annealing
• Surface texturing
• Surface marking
• Surface etching
• ITO removal
• Ablation

Materials

• Aluminum (cast, anodized, polished)
• Multi-coated materials
• Painted metal alloy
• Galvanized metals
• Backlit buttons
• Thermal paper
• Polycarbonate
• Polypropylene
• Stainless steel
• Polysulphone
• Titanium
• Cast Iron
• Chrome
• Carbide
• Plastics
• Rubber
• Silicon
• Nylon
• Nickel
• Valox
• Glass
• Steel
• PVC
• Tin
### Specifications and Facility Requirements

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>i-Series Pulsed Fiber Laser</th>
<th>i-Series CW Fiber Laser (20 W)</th>
<th>i-Series CW Fiber Laser (50 W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of operation</td>
<td></td>
<td>Pulsed</td>
<td>CW</td>
<td>CW</td>
</tr>
<tr>
<td>Energy per pulse (PRR = 20kHz)</td>
<td>mJ</td>
<td>0.5, 1.0, 2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polarization</td>
<td></td>
<td>Random</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central emission wavelength</td>
<td>nm</td>
<td>1060-1070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission bandwidth (FWHM)</td>
<td>nm</td>
<td>&lt;5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse width (FWHM)</td>
<td>ns</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse repetition rate</td>
<td>kHz</td>
<td>20-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal average output power</td>
<td>W</td>
<td>10, 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output power range %</td>
<td>%</td>
<td>10 - 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term power stability %</td>
<td>%</td>
<td>&lt;5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical beam quality, M²</td>
<td></td>
<td>1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output fiber delivery length</td>
<td>m</td>
<td>3-5 for 0.5mJ, 13 for 1mJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating voltage</td>
<td>VAC</td>
<td>110/220</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. power consumption</td>
<td>W</td>
<td>150, 180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm</td>
<td>240(W) x 244(D) x 225(H)</td>
<td>240(W) x 244(D) x 225(H)</td>
<td>240(W) x 244(D) x 225(H)</td>
</tr>
<tr>
<td>Weight (aprox.)</td>
<td>kg</td>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Control Board

The PC Interface board provides synchronous, interference-resistant control of the scan system and laser in real time. A high-performance signal processor and the supplied DLL simplify programming by using Windows software. Instructions are loaded alternately in two list buffers which are processed by the DSP and outputed as 16-bit control signals every 10μs to the scan system. The processor automatically performs vital steps such as micro-vectorization and image field correction. Laser control is synchronized with the scanner movements.

- **Interface**: PCI bus interface
- **Resolution**: 16-bit position resolution
- **Output Period**: 10 μs

### Scanning Head

The scanning head is designed to quickly and precisely deflect and position laser beams with powers up to the kilowatt range. With apertures of 10mm, small spot sizes are achieved along with up to 4” x 4” image fields.

Very stable operating conditions as well as long-term stability are provided by air cooling of the entrance aperture, electronics and galvanometer scanners supplemented by air cooling of the deflection mirrors. The compact housing is dustproof and water resistant.
Dynamic Performance Facility Requirements

**Repeatability**
- < 22 μrad operating temperature 25°C±10°C

**Offset Drift**
- < 25 μrad/k typical air requirements clean, filtered air 20 l/min. at Δp <2bar

**Gain Drift**
- < 80 ppm/k

**Long Term Drift**
- < 0.3 mrad (over 8 hours)

**Positioning Speed**
- 12.0 m/sec

**Good Writing Quality / Speed**
- 900 cps

**Interface**
- Digital

**Tracking Error**
- 0.14 ms

Optical Performance

**Focal Length:**
- 100 – 200MM typical scan angle of scanner 1 ±0.26 rad (approximately 100 x 100mm)

**Zero Offset:**
- < 5 mrad typical scan angle of scanner 2 ±0.40 rad

**Skew:**
- < 1.5 mrad typical field size – ellipse 80mm x 130mm

**Nonlinearity:**
- < 2.1 mrad typical field size – square 75mm x 75mm to 110 x 110mm

**Gain Error:**
- < 5 mrad

Legend
1. Beam entrance
2. Scan head
3. Objective
4. Emerging beam
5. Image field

Dimensions
- B = 22.41 mm
- E = 42.52 mm

Note: drawing not true-to-scale

---

<table>
<thead>
<tr>
<th>Objective</th>
<th>Laser Type</th>
<th>Wavelength</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>Typical Image Field Size (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focal Length (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56 YAG</td>
<td>1064</td>
<td></td>
<td>106</td>
<td>32</td>
<td>53</td>
<td>99</td>
<td>57.15</td>
<td>(18 x 18)</td>
</tr>
<tr>
<td>100 YAG</td>
<td>1064</td>
<td></td>
<td>157</td>
<td>32</td>
<td>60</td>
<td>90</td>
<td>57.15</td>
<td>(59 x 59)</td>
</tr>
<tr>
<td>160 YAG</td>
<td>1064</td>
<td></td>
<td>233</td>
<td>32</td>
<td>58</td>
<td>90</td>
<td>57.15</td>
<td>(110 x 110)</td>
</tr>
</tbody>
</table>

**Focal Length:**
- 100 – 200MM typical scan angle of scanner 1 ±0.26 rad (approximately 100 x 100mm)

**Zero Offset:**
- < 5 mrad typical scan angle of scanner 2 ±0.40 rad

**Skew:**
- < 1.5 mrad typical field size – ellipse 80mm x 130mm

**Nonlinearity:**
- < 2.1 mrad typical field size – square 75mm x 75mm to 110 x 110mm

**Gain Error:**
- < 5 mrad
# Comparable Advantages of Fiber Laser Over Nd:YAG

<table>
<thead>
<tr>
<th>Laser System</th>
<th>20 Watt TEMoo Fiber Laser</th>
<th>50-100 Watt Multimode (Lamp or Diode) 20 Watt TEMoo Diode Nd:YAG Laser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser and power supplies</td>
<td>$47,500</td>
<td>$55,000 - $65,000</td>
</tr>
<tr>
<td>Computer and software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q-switch RF driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scan head and control cards</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTBF (Mean Time Between Failure)</td>
<td>50,000 to 100,000 Hours</td>
<td>500 to 1,000 Hours (Lamp-pumped) 10,000 to 20,000 Hours (Diode-pumped)</td>
</tr>
<tr>
<td><strong>Consumables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Fiber Laser modules can be repaired – average repair costs range from $1,000 to $5,000 USD</td>
<td>$5,000 - $15,000 (Lamps - $100 each) (Diode packs - $5,000 to $12,000 each)</td>
<td></td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Two eight hour shifts running 365 days at 0.04 kW)</td>
<td>$59.71 yearly 170 W an hour</td>
<td>$1,401.60 yearly 6 kw an hour</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No consumables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No cleaning or aligning of mirrors or Beam path</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No filters (Chiller)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost: $0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optical path requires often adjustments to optimize power output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Periodic replacement of flash lamps, diode packs, and solid state crystals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely temperamental diode packs often require factory-trained technicians—takes several hours in many cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning, replacement and aligning of laser mirrors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost: $1,500 - $10,000 (Individual results may vary, diode pumped systems require significant training for replacement procedure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power Efficiency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3% (0.2% with 3x Nd:YAG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Beam Quality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round &amp; concentric Near M2=1 (&lt;1.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not symmetric on both axes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Spot Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Due to the excellent M2, spot size is 50% smaller than Nd:YAG. Requires less power for the same result in comparison with the Nd:YAG system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significantly bigger than the Fiber Laser. Requires more lasing power to achieve the same result.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Optical Path/Beam Path</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible Cable (up to 50m)</td>
<td>Mirrors and optical path Loss of beam quality and significant power drop-off with fiber delivery scan head system</td>
<td></td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air cooled</td>
<td>De-ionized (DI) water</td>
<td></td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19” rack mount unit</td>
<td>Large footprint</td>
<td></td>
</tr>
<tr>
<td><strong>Chiller</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Chiller necessary up to 200 watt Q-switched (pulsed) or CW.</td>
<td>30x watt to laser output power Cost: $5,000 - $8,000 (Replacement required every 1 – 2 yrs)</td>
<td></td>
</tr>
<tr>
<td>Cost: $0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cost of Ownership First Year</strong></td>
<td>$47,539.71</td>
<td>$99,400.00</td>
</tr>
<tr>
<td><strong>You Save First Year</strong></td>
<td>$51,860.29</td>
<td></td>
</tr>
</tbody>
</table>
FiberScan C3™ Software
FiberScan C3™ software is a high performance, multi-threaded laser marking solution designed to specifically run on Windows 2000 Professional and Windows XP Professional. The user-friendly software entails a fully integrated driver, remote diagnostic capabilities for worldwide support and multiple hardware interfaces for the ability to execute any CO₂ or Fiber Laser marking system. File links to several internal databases make the FiberScan C3™ program flexible and powerful. These databases include a materials application system and a fixture database. The materials application system allows a user to define a laser process, give the process a unique name and subsequently link the process to graphic programs. A process can include multiple passes using different values for power, frequency and speed on each laser pass. The database can contain and manage many thousands of different process ‘recipes’.

The fixture database allows the user to control fixture offsets and define step and repeat processes. Just like the material database, any WLJ job can use any fixture defined in the fixture database. The links allow all appropriate graphic and process information to be automatically loaded when the operator selects the lasing file. At any time the operator can change the links, for example a lasing job that is normally marked on stainless steel, can be marked on brass by selecting the brass process file prior to executing the job program file.

Operators don’t have the need to remember fonts and logos for a particular job because FiberScan C3™ automatically performs all required graphic loading. FiberScan C3™ does not require users to learn any programming languages or special codes and provides all of the flexible and graphic controls that users are accustomed to such as radial marking, aspect control, character spacing, angular rotations and full justification.
Application Research Center
Laser Photonics maintains an applications lab for processing customer samples and assisting with process development. Our applications lab has the latest testing equipment to analyze all of your application needs.

For marking applications, we provide the highest quality analysis of each and every mark using our Mark Quality Assessment™ (MQA™) software. With our MQA™ software, we have the ability to guarantee and verify the accuracy and quality of our marks.

The screen shot below demonstrates how the MQA™ software reads the level of pixels in the material marked. The section in red has been analyzed with the MQA™ software. The high and low pixel values demonstrate the overall contrast of the mark.

This procedure can be applied to various different marking processes and types generated by our Fiber Laser marking systems. We will prepare and research all applications within a matter of two to three weeks and provide a detailed report free of charge.

Article References and Related Technical Documents:

1. **Marking With Fiber Lasers**
   (http://ils.pennnet.com/Articles/Article_Display.cfm?Section=Archives&Subsection=Display&ARTICLE_ID=204542&KEYWORD=fiber%20laser%20marking)
2. **Fiber Frenzy**
   (http://ils.pennnet.com/Articles/Article_Display.cfm?Section=Articles&Subsection=Display&ARTICLE_ID=205998&KEYWORD=fiber%20laser%20marking)
3. **Materials Processing With Fiber Lasers**
   (http://ils.pennnet.com/Articles/Article_Display.cfm?Section=Archives&Subsection=Display&ARTICLE_ID=167291&KEYWORD=fiber%20laser%20marking)
4. **Marking Manages Inventory**
   (http://www.industrial-lasers.com/articles/article_display.html?id=201734)
5. **Advantages of Fiber vs. YAG lasers**
   (http://www.laserphotonics.com/docs/LPC_FiberVersusYag.pdf)
6. **Application Reports**
7. **Laser Safety**
**Advanced Support**
- Remote laser diagnostics through TCP/IP protocol
- Remote diagnostics and upgrades
- Remote systems restore
- Multilingual software
- World wide support
- Built in help index
- Remote training

**International Support**
*Multilingual software with worldwide support*
- Australia
- Brazil
- Canada
- China/Hong Kong
- India
- Malaysia
- Mexico
- Philippines
- Qatar
- Russia
- Singapore
- Taiwan
- Thailand
- Turkey
- and more

**2 year warranty on laser components with 5 year optional program**
Safety Considerations During Operation
1064 nm wavelength laser light emitted from this laser system is invisible and may be harmful to the human eye. Proper laser safety eye wear must be worn during operation.

21 CFR 1040.10 Compliance
This product is designed for OEM integration into other equipment. The product is a Class 4 laser as designated by the CDRH and it does NOT MEET the full requirements for a stand-alone laser system as defined by 21 CFR 1040.10 under the Radiation Control for Health and Safety Act of 1968. It is the responsibility of the equipment manufacturer to meet all of the regulatory requirements for the final system.

IMPORTANT NOTICE: ALL SPECIFICATIONS, TECHNICAL DATA AND OTHER INFORMATION CONTAINED IN THIS DOCUMENT, AND ALL STATEMENTS ABOUT THE PRODUCT(S) IDENTIFIED IN THIS DOCUMENT, ARE PRELIMINARY IN NATURE AND ARE PROVIDED “AS IS,” WITHOUT WARRANTY OR ASSURANCE OF ANY KIND. LASER PHOTONICS MAKES NO REPRESENTATION OR WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE PRODUCT(S) OR THEIR SPECIFICATIONS. ALL INFORMATION IS SUBJECT TO CHANGE. PLEASE CONTACT LASER PHOTONICS FOR MORE INFORMATION. LASER PHOTONICS AND THE LASER PHOTONICS LOGO ARE TRADEMARKS OF LASER PHOTONICS CORPORATION. OTHER TRADEMARKS ARE THE PROPERTY OF THEIR RESPECTIVE OWNERS. COPYRIGHT LASER PHOTONICS CORPORATION. ALL RIGHTS RESERVED.
Laser Photonics, LLC is the industry leader in developing high-tech Fiber and CO₂ laser systems. Laser Photonics exclusively specializes in advanced, innovative, latest generation laser systems, processes and technologies. We focus on cutting edge Fiber Laser technology for material processing. We have delivered hundreds of Fiber Laser cutting and engraving machines to countries worldwide. Contact us to learn more about our marking, cutting and engraving systems.