

A DIVISION OF FONON TECHNOLOGY INTERNATIONAL

# *i*-Series

OEM MARKING KIT - FIBER LASER

**i-Series** Fiber Laser was specifically designed for maintenance-free OEM applications. It delivers a diffraction limited ( $M2 < 1.05$ ) laser beam directly to the worksite via metal sheathed single mode fiber cable.

These compact service-free lasers are designed to operate under high shock, vibration and dust conditions, with relatively high humidity and temperatures. They do not require routine replacement parts or materials; only a low voltage power source.

This system offers power efficiencies up to 50%, a compact size, reduced utilities and trouble-free air cooling. Fiber-to-fiber architecture means a robust, monolithic design with no optics to align or maintain and no mechanics to stabilize. The i-Series also offers focusable power and high power densities needed for the most demanding applications.

### **Features and Benefits**

- Most advanced, reliable, industrial grade, cost effective and maintenance-free Fiber Laser marking system available on the market today
- Built in I/O for easy integration into assembly line or conveyer line without a PC connection which eliminates computer downtime
- Minimal number of external connection cables makes it the easiest OEM package to integrate into existing equipment
- State-of-the-art, air-cooled, Ytterbium Q-Switched Fiber Laser for marking on virtually any material (metals, plastics, ceramics, etc.)
- Integrated design with laser control and power supplies in one box for both scan heads
- Single or Dual Head Configuration working as a master/slave or independently
- Designed for maintenance-free Direct Part Marking (DPM) applications
- i-Series Fiber Lasers integrated with scan head power supply
- Double Fast™ Digital Scanning Head with 7 mm aperture
- Low voltage power source (110/220 VAC) requirements
- Greater than 50,000 hours maintenance-free operation
- “Plug and play” operation with remote troubleshooting
- Excellent beam quality ( $M2 = 1.4$ )-TEM00 beam profile
- F-Theta lenses objective with 160 mm focal length
- Mounting hardware and cables
- 3 meter optical fiber cable
- FiberScan C3™ software

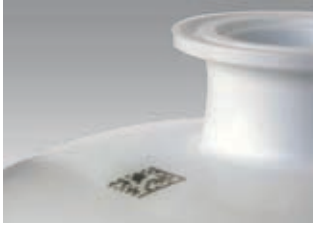
### **No PC Required**

With a built in DSP module system 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 laser files. 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 upgradeable with DSP ISA card and signal converter and marking/laser control software installed
- 3D package for focal distance alignment without mechanical Z-axis; supplied as manually adjusted optical component or fully integrated software controlled 3D package
- Optional Dual Head master/slave configuration which allows both heads to work independently and can double the speed of the marking process; this could be very useful for marking a large quantity of parts with the same pattern
- Built-in DSP module system on a master laser to work without a PC connected
- PC with a flat panel monitor (or touch screen monitor), mouse and keyboard
- 2 units of i-Series Fiber Lasers configured for Dual Scan head operation
- I/O extension board (optically isolated 7 input and 5 output ports)
- 2 Double Fast™ digital scanning heads with 7 or 10 mm aperture
- F-Theta lens availability: 68, 100, 160, 254, 330 and 420mm
- Two F-Theta lenses with customer selected focal length
- Red diode pointer for easy set-up and alignment
- Dual hard drives or solid state storage available
- Remote control interface for all components
- Beam shaping optics for smaller beam size
- External interlock
- Optical isolator





## Applications

- Common applications: alphanumerics, logos, serial numbers, part numbers, lot/date codes, schematics, complex graphics, direct parts marking, bar-coding, 2D data matrix codes, pictures and logos etching (material vaporization)
- Layer by layer dark paint removal for radio buttons and backlit panels
- OCR code marking (human and machine readable)
- Circumferential markings (mark round parts)
- Paint removal from plastic surfaces
- Production line inline integration
- 2D Symbolologies linear barcodes
- IC chip package marking
- Marking "on the fly"
- Surface annealing
- Surface texturing
- Surface marking
- Surface etching
- ITO removal
- Ablation
- Cutting

## Materials

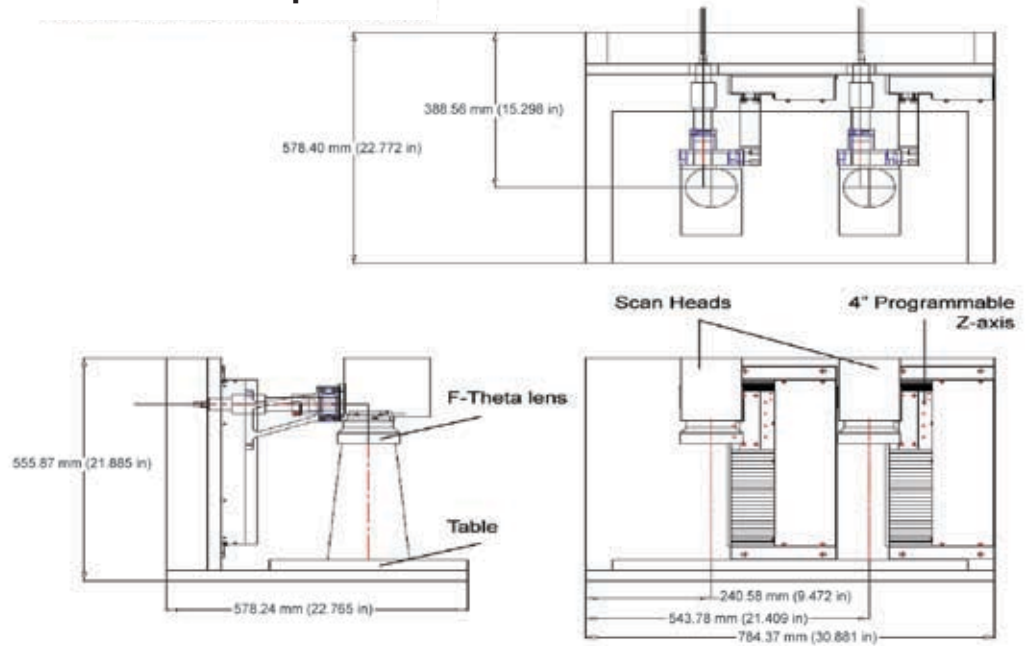
- Aluminum (cast, anodized, polished)
- Multi-coated materials
- Painted metal alloy
- Galvanized metals
- Painted plastics
- Polycarbonate
- Polypropylene
- Stainless steel
- Composites
- Titanium
- Cast iron
- Chrome
- Carbide
- Plastics
- Rubber
- Nickel
- Steel
- PVC



## Sample Installation

Typical installation in dual head configuration shown below. Two heads with 100 x 100 mm marking fields create overall coverage of 100 x 200 mm, which is sufficient for some semiconductor applications. The real field size can go up to 287 x 287 per head or 287 x 574 mm with 420 mm F-Theta lens selection.

### Sample Installation - Double Scan Head

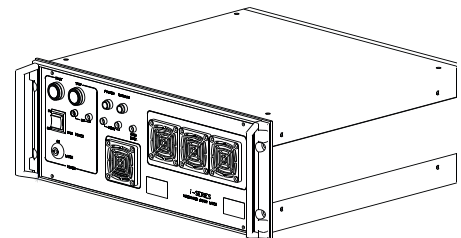
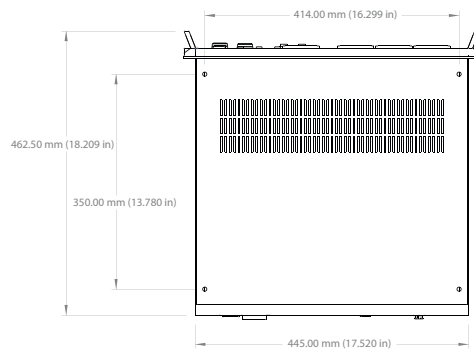
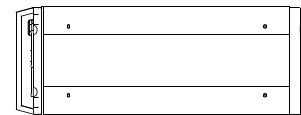
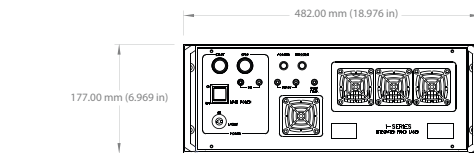


## Specifications and Facility Requirements

Parameters	Unit	i-Series Pulsed Fiber Laser
Mode of operation		Pulsed
Energy per pulse (PRR = 20kHz)	mJ	0.5, 1.0, 2.0
Polarization		Random
Central emission wavelength	nm	1060-1070
Emission bandwidth (FWHM)	nm	<5
Pulse width (FWHM)	ns	100
Pulse repetition rate	kHz	20-100
Nominal average output power	W	10, 20
Output power range	%	10 -100
Long term power stability	%	<5
Typical beam quality, M <sup>2</sup>		1.4
Output fiber delivery length	m	3-5 for 0.5mJ, 13 for 1mJ
Operating voltage	VAC	110/220
Max. power consumption	W	150, 180
Dimensions	mm	420 x 420 x 150
Weight (aprox.)	kg	16

Parameters	Unit	i-Series CW Fiber Laser 20 W	i-Series CW Fiber Laser 50 W
Mode of operation		CW	CW
Polarization		Random	Random
Central emission wavelength	nm	1060-1120	1070-1090
Nominal output power	W	20	50
Output power turnability	%	10-100	10-100
Output power stability:			
Long-term (over 5 hrs)	%	2	3
Short-term (1kHz-100 MHz)	% rms	1	1.5
Emission linewidth (FWHM)	nm	<1	<2
Output fiber length	m	1-20	1-10
Operating voltage (DC)	V	24	24
Max. power consumption	W	110	240
Dimensions	mm	420 x 420 x 150	420 x 420 x 150
Weight (aprox.)	kg	16	17.5

## Fiber Laser Dimensional Drawings







## 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 outputted as 16-bit control signals every 10 $\mu$ s 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.

<b>Interface</b>	PCI bus interface
<b>Resolution</b>	16-bit position resolution
<b>Output Period</b>	10 $\mu$ s



## 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.

## Typical Applications:

Various applications for the Semiconductor, Flat panel display and electronics industries. Marking in the packaging sector and Deep engraving.

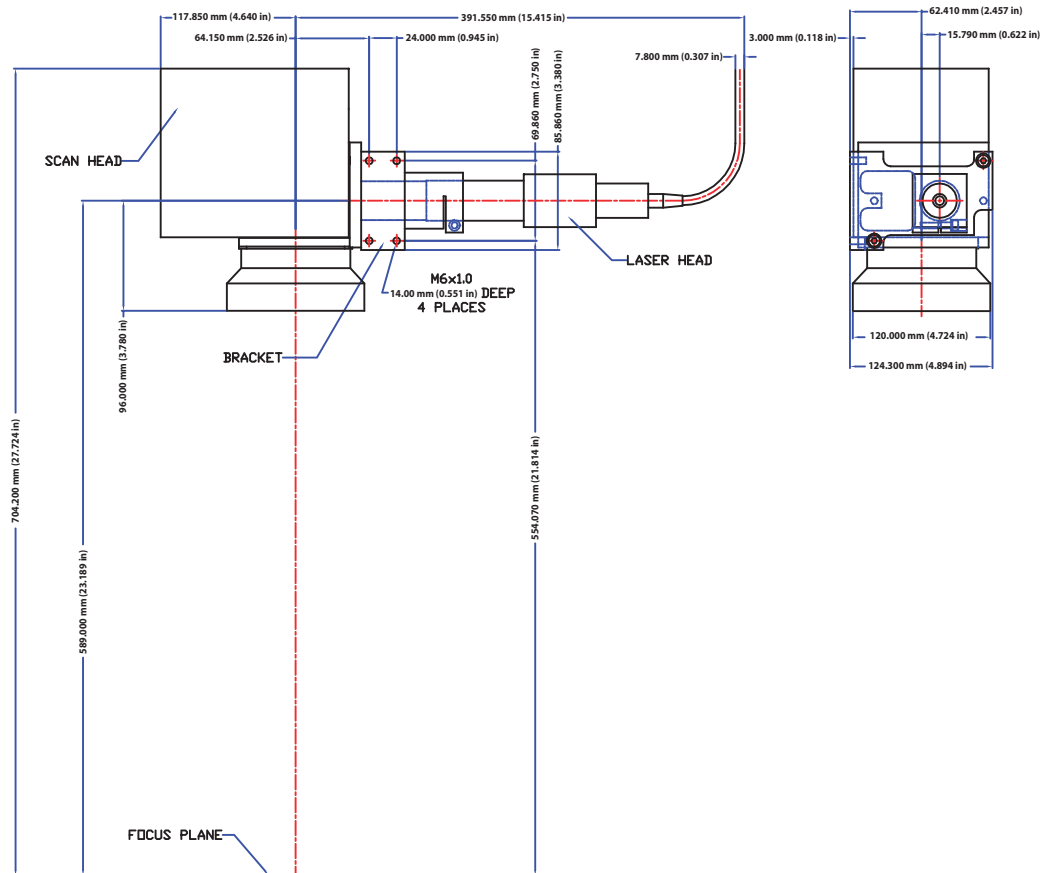
## Dynamic Performance Facility Requirements

<b>Repeatability</b>	< 22 $\mu$ rad operating temperature 25°C $\pm$ 10°C
<b>Offset Drift</b>	< 25 $\mu$ rad/k typical air requirements clean, filtered air 20 l/min. at $\Delta$ p <2bar
<b>Gain Drift</b>	< 80 ppm/k
<b>Long Term Drift</b>	< 0.3 mrad (over 8 hours)
<b>Positioning Speed</b>	12.0 m/sec
<b>Good Writing Quality / Speed</b>	900 cps
<b>Interface</b>	Digital
<b>Tracking Error</b>	0.14 ms

## Optical Performance

<b>Focal Length:</b>	100 – 200MM typical scan angle of scanner 1 $\pm$ 0.26 rad (approximately 100 x 100mm)
<b>Zero Offset:</b>	< 5 mrad typical scan angle of scanner 2 $\pm$ 0.40 rad
<b>Skew:</b>	< 1.5 mrad typical field size – ellipse 80mm x 130mm
<b>Nonlinearity:</b>	< 2.1 mrad typical field size – square 75mm x 75mm to 110 x 110mm
<b>Gain Error:</b>	< 5 mrad

## Scanning Head Assembly







## Comparable Advantages of Fiber Laser Over Nd:YAG

	20 Watt TEMoo Fiber Laser	50-100 Watt Multimode (Lamp or Diode) 20 Watt TEMoo Diode Nd:YAG Laser
<b>Laser System</b>	\$47,500	\$55,000 - \$65,000
<ul style="list-style-type: none"> <li>• Laser and power supplies</li> <li>• Computer and software</li> <li>• Q-switch RF driver</li> <li>• Scan head and control cards</li> </ul>		
<b>Reliability</b> MTBF (Mean Time Between Failure)	50,000 to 100,000 Hours	500 to 1,000 Hours (Lamp-pumped) 10,000 to 20,000 Hours (Diode-pumped)
<b>Consumables</b>	\$0 Note: Fiber Laser modules can be repaired – average repair costs range from \$1,000 to \$5,000 USD	\$2,000 - \$15,000 (Lamps - \$100 each) (Diode packs - \$5,000 to \$12,000 each)
<b>Power Consumption</b> (Two eight hour shifts running 365 days at \$.04 kW)	\$39.71 yearly 170 W an hour	\$1,401.60 yearly 6 kw an hour
<b>Maintenance</b>	<ul style="list-style-type: none"> <li>• No maintenance</li> <li>• No consumables</li> <li>• No cleaning or aligning of mirrors or Beam path</li> <li>• No filters (Chiller)</li> </ul> Cost: \$0.00	<ul style="list-style-type: none"> <li>• Optical path requires often adjustments to optimize power output</li> <li>• Periodic replacement of flash lamps, diode packs, and solid state crystals</li> <li>• Extremely temperamental diode packs often require factory-trained technicians–takes several hours in many cases</li> <li>• Cleaning, replacement and aligning of laser mirrors</li> </ul> Cost: \$1,500 - \$10,000 (Individual results may vary, diode pumped systems require significant training for replacement procedure)
<b>Power Efficiency</b>	Up to 50%	2-3% (0.2% with 3x Nd:YAG)
<b>Beam Quality</b>	Round & concentric Near M2=1 (<1.05)	Not symmetric on both axes
<b>Spot Size</b>	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.	Significantly bigger than the Fiber Laser. Requires more lasing power to achieve the same result.
<b>Optical Path/Beam Path</b>	Flexible Cable (up to 50m)	<b>Mirrors and optical path</b> Loss of beam quality and significant power drop-off with fiber delivery scan head system
<b>Cooling</b>	Air cooled	De-ionized (DI) water
<b>Size</b>	19" rack mount unit	Large footprint
<b>Chiller</b>	No Chiller necessary up to 200 watt Q-switched (pulsed) or CW. Cost: \$0	30x watt to laser output power Cost: \$5,000 - \$8,000 (Replacement required every 1 – 2 yrs)
<b>Total Cost of Ownership First Year</b>	\$47,539.71	\$99,400.00
<b>You Save First Year</b>	\$51,860.29	

## OEM Fiber Laser Marking System Options

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### Touch Screen Interface



### 4" Or 8" Precision Z-Axis

- Life lubricated preloaded linear slide
- Precision ball screw
- Dust protective way covers
- Contact free home and positioning sensors
- Stainless steel cover



### Mounting Hardware



### Barcode, 2D Data Matrix Code Scanners for Marking Quality Verification



### Optional Cables, Connectors, and Miscellaneous Electronics



### Vision System Product Recognition/Alignment System



### Vision System Marking Quality Verification



## OEM Fiber Laser Marking System Options (cont.)

Optional scanning heads

Custom solution and configuration

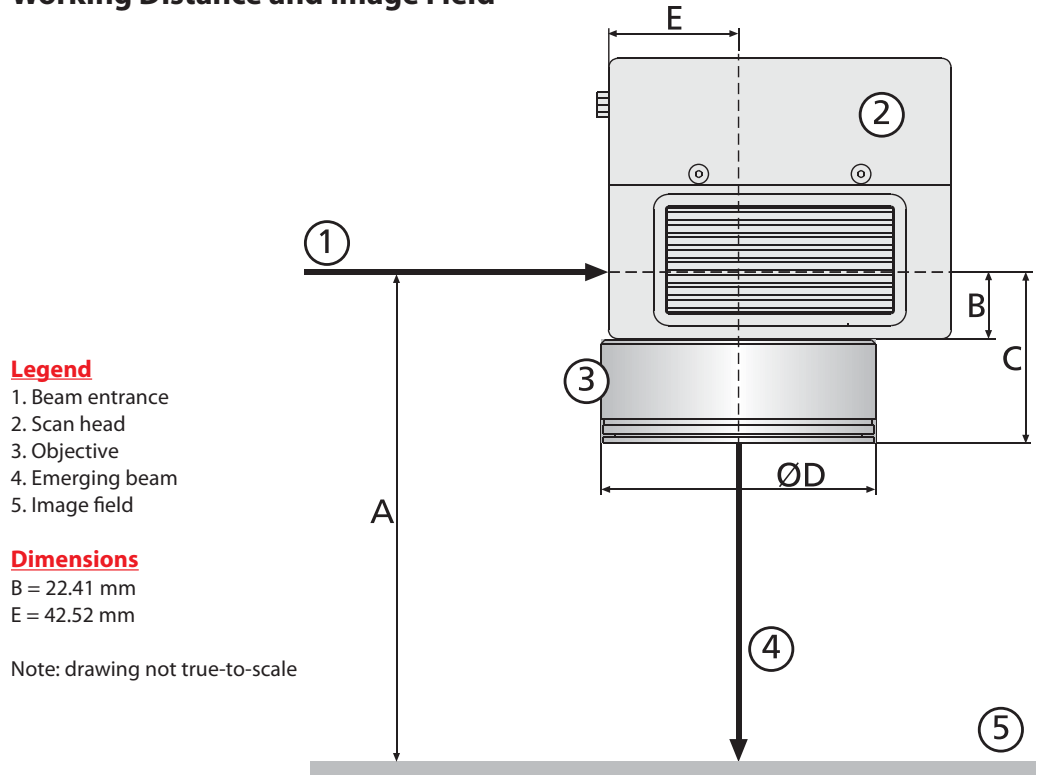
Customized beam shaping solutions

Custom I/O

Custom safety interface

Inline and “on the fly” installations

## Working Distance and Image Field



Objective			A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Typical Image Field Size (mm <sup>2</sup> )
Focal Length (mm)	Laser Type	Wavelength						
100	FIBER LASER	1064	157	32	60	90	57.15	(59 x 59)
160	FIBER LASER	1064	233	32	58	90	57.15	(110 x 110)
254	FIBER LASER	1064	390	32	94	120	57.15	(170 x 170)
330	FIBER LASER	1064	483	32	96	120	57.15	(230 x 230)
420	FIBER LASER	1064	589	32	96	120	57.15	(290 x 290)

#### Software Features Include:

- Multilingual internationalized interface
- COM (Component Object Model) interface
- True type font and laser engraving fonts
- Background templates
- Controls any laser type
- Open multiple jobs

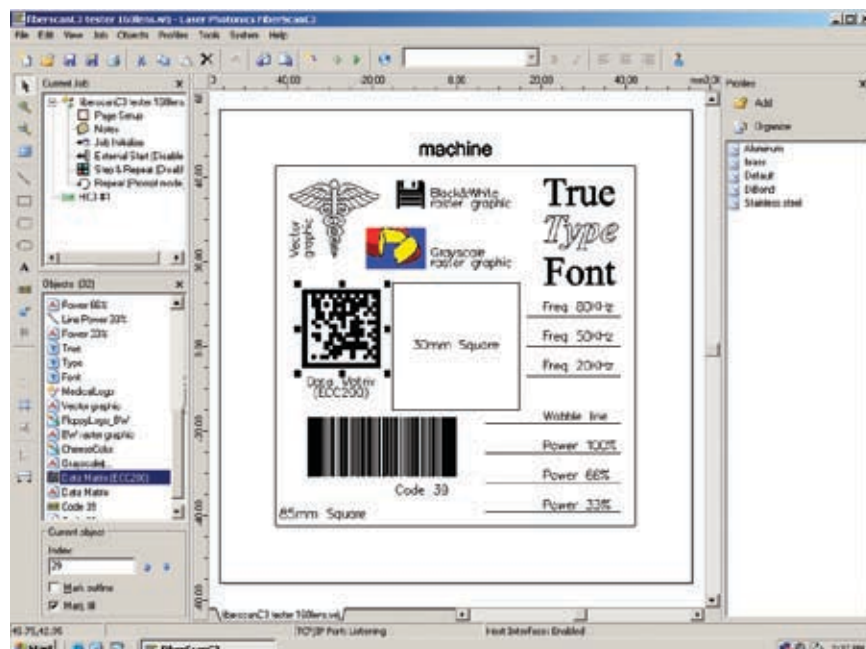


## FiberScan C3™ Software

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 CO<sub>2</sub> 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.



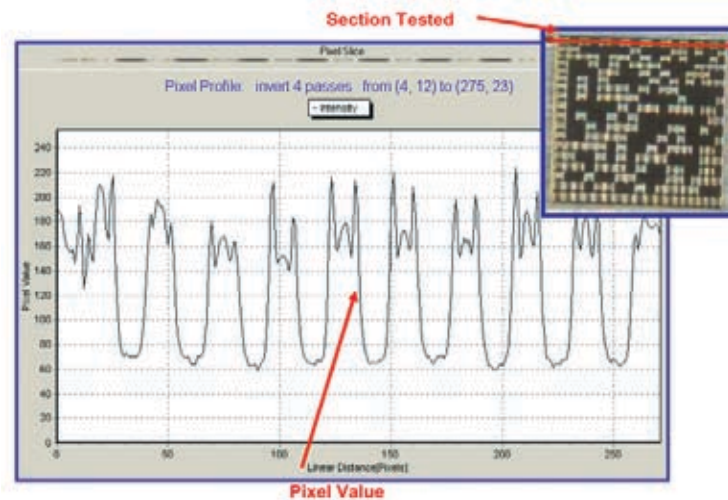
## Application Research Center

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](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](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](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](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](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

**2 year warranty  
on laser components  
with 5 year optional program**

### 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







### 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.

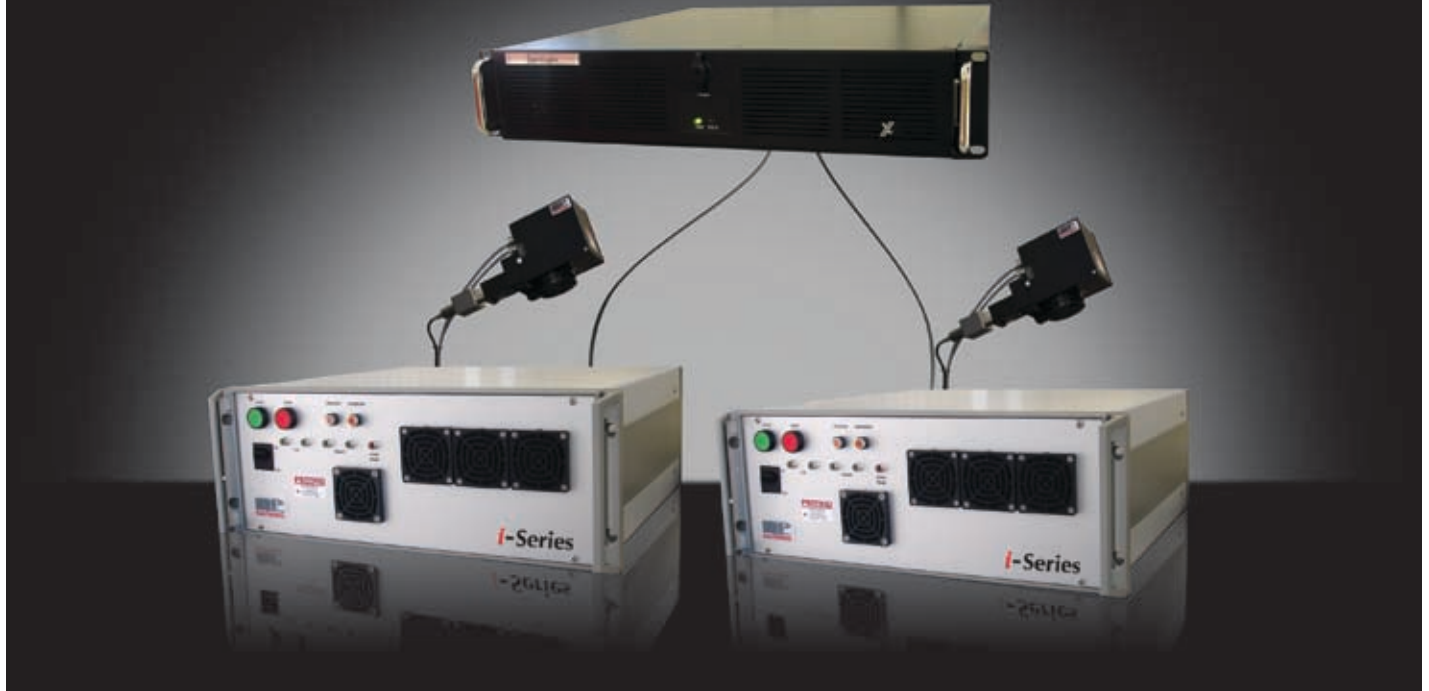
The product is a Class 4 laser as designated by the CDRH and it does NOT MEET the full requirements for a stand-alone laser system as defined by 21 CFR 1040.10 under the Radiation Control for Health and Safety Act of 1968. It is the responsibility of the equipment manufacturer to meet all of the regulatory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



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## Laser Photonics - Product Range

### i Series



**Cutting Systems**



**Titan Series**



**Handheld**



**FiberTower™ Series**

Laser Photonics, LLC is the industry leader in developing high-tech Fiber and CO<sub>2</sub> 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.



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