



## i-Series Fiber Laser Marking Kit

Dual-Head Capability



### Main features:

- Most advanced, reliable, industrial grade, cost effective, and maintenance free fiber Laser marking system available on the market today
- Easy integration into assembly line or conveyer line without PC connection which eliminates computer downtime
- Plug and Play operation with remote troubleshooting
- State-of-the-art, Air-Cooled, Ytterbium Q-Switched Fiber Laser for marking on virtually any material (metals, plastics, ceramics; etc.)
- Minimal number of external connection cables makes it the easiest OEM package to integrate into customer equipment or conveyer line.
- Single or Dual Head Configuration working as a Master/Slave or totally Independently
- Optional Dual Head master-slave configuration which doubles the speed of the marking process. This could be very useful for marking a large quantity of parts with the same pattern.
- Integrated Design with laser, laser control and power supplies in one box for each of the two scan heads
- Optional Integrated high speed DSP and on board computer with 32 Mb media flash memory card to store marking and lasing files.

- Ability to work without computer connected to the laser system (Optional Configuration).
- Designed for maintenance-free Direct Part Marking (DPM) applications
- PC with user-friendly software supplied
- Excellent beam quality ( $M2=1.4$ )- $TEM_{00}$  beam profile
- Greater than 50,000 hours maintenance-free operation
- Low voltage power source (110/220 VAC) requirements.
- Built-in I/O for integration into a production line or other equipment.

### No PC Option:

With built-in DSP module system operates 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 computer with 32 Mb media flash memory card stores marking and lasing files. System connects to stand alone PC or Laptop via standard USB cable. After files are uploaded there is no further need for the computer to be connected to the laser system.



### Standard configuration includes:

- i-Series Fiber Lasers integrated with Scan head Power supply.
- Double Fast™ Digital Scanning Head with 7 mm aperture
- F-Theta Lenses objective with 160 mm Focal Length
- Mounting Hardware and Cables
- Optical Fiber Cable 3 meters
- FiberScan Software
- I/O extension board (Optically isolated 7 input and 5 output ports)
- 19" rack 2U industrial PC-based controller. Latest Generation Computer, open configuration, field upgradeable with DSP ISA card, Opto-Isolated I/O Extension card, and signal converter and marking/Laser control software installed. Dual hard drives or solid state storage available.

### Optional configuration includes:

- 3D package for focal distance alignment without mechanical Z-axis. Supplied as manually adjusted optical component or fully integrated software controlled 3D package.
- 2 units of i-Series Fiber Lasers configured for Dual Scan head operation
- Master/ Slave configuration or both heads works independently from each other.
- Built-in DSP module system on a Master Laser to work without a PC connected. 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.
- 2 Double Fast™ Digital Scanning Heads with 7 or 10 mm aperture
- Two F-Theta Lenses with customer selected Focal Length
- F-Theta lens availability: 68, 100, 160, 254, 330 and 420mm
- 19" rack enclosure for laser, scan head and PC controllers.
- Remote control interface for all components
- External interlock
- Beam shaping optics for smaller beam size
- Optical isolator

- Flat panel monitor (or touch screen monitor), mouse and keyboard
- Red diode pointer for easy set-up and alignment

**More options are available to help OEM customers build their demanding equipment.**

**Please choose from below.**

### **i-Series 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 a 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; they require only a low voltage power source. Wall-plug efficiencies up to 50% result in 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, no mechanics to stabilize, and with the focusable power and high power densities needed for the most demanding applications.



### **Applications:**

- IC Chip Package Marking
- Layer by layer dark paint removal for radio buttons and backlit panels
- Direct Parts Marking, Bar-coding, 2D Data Matrix Codes, Lot Codes, Date Codes
- Surface Annealing
- Surface Etching
- Ablation
- Cutting
- Paint Removal from plastic surfaces
- Surface marking
- OCR Code Marking (Human and Machine Readable)
- Common Applications: Alphanumerics, Logos, Serial Numbers, Part Numbers, Lot / Date Codes, Schematics, Complex Graphics, Pictures, and Logos Etching (Material Vaporization),
- Surface Texturing
- Circumferential Markings (Mark Round Parts)
- ITO Removal
- 2D Symbologies Linear Barcodes
- Marking "On the Fly"
- Production Line Inline Integration

### **Material/Product Suitability:**

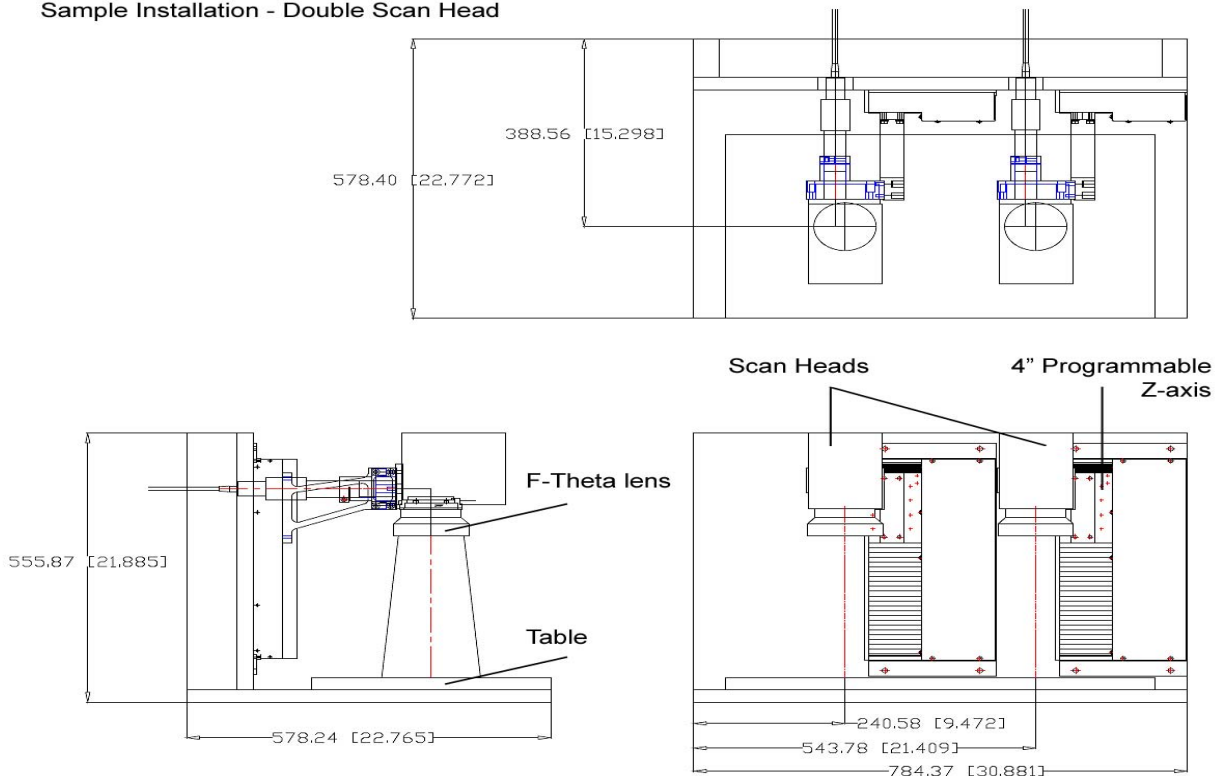
- |                                       |                    |
|---------------------------------------|--------------------|
| • Stainless Steel                     | • Plastics         |
| • Aluminum (Cast, Anodized, Polished) | • Painted plastics |
| • Carbide                             | • Backlit Buttons  |
| • Nickel                              | • Polycarbonate    |
|                                       | • Titanium         |

- Polypropylene
- PVC
- Rubber
- Steel
- Cast Iron
- Chrome
- Painted Metal Alloy
- Multi-coated Materials
- Galvanized Metals
- Composites

## Sample Installation

Typical installation in Dual head configuration shown below. 2 heads with 100 x 100 mm marking field create overall coverage of 100 x 200 mm which is enough for some of the 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. However one must understand that this is conditioned to require marking quality.

Sample Installation - Double Scan Head

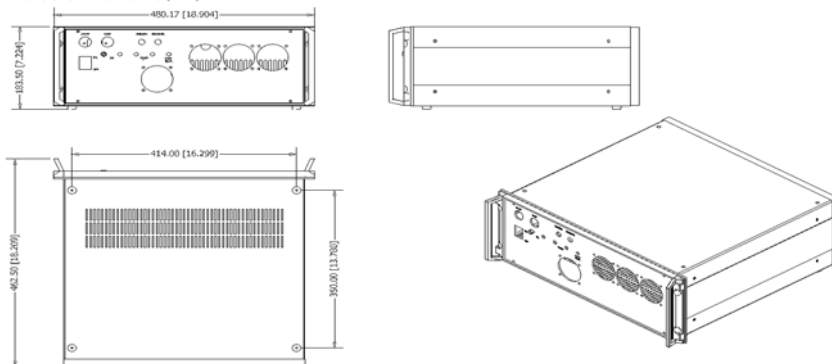


## Specifications and Facility Requirements

Parameters	Unit	i-Series Pulsed Fiber Laser	
Mode of operation		Pulsed	
Energy per pulse (PRR = 20kHz)	mJ	0.5, 1.0	
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, 1-3 for 1mJ	
Operating voltage	VAC	110/220	
Max. power consumption	W	150, 180	
Dimensions	mm	480 x 465 x 185	
Weight	kg	10	
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	480 x 465 x 185	480 x 465 x 185
Weight	kg	8	16

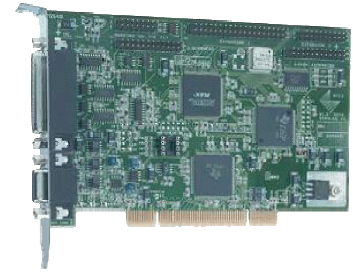
## Fiber Laser Dimensional Drawings

NOTES:  
ALL DIMENSIONS IN MILLIMETERS (INCH).



## 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 under Windows. Software instructions are loaded alternately in two list buffers processed by the DSP and output 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.

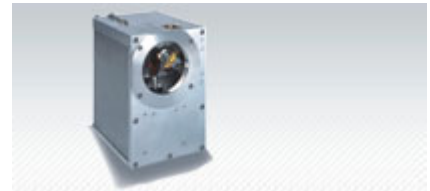


Interface:	PCI bus interface
Resolution:	16-bit positioning resolution
Output Period:	10 µs

## Scanning Head

The scan 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 4" by 4" image fields.

Very stable operating conditions as well as high 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 spray resistant.



## Typical Applications:

- Marking in the packaging sector
- Deep Engraving
- Semiconductor industry
- Flat Panel Display and Electronics industry

## 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 whiting quality writing 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 100 mm)
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

**Software:**

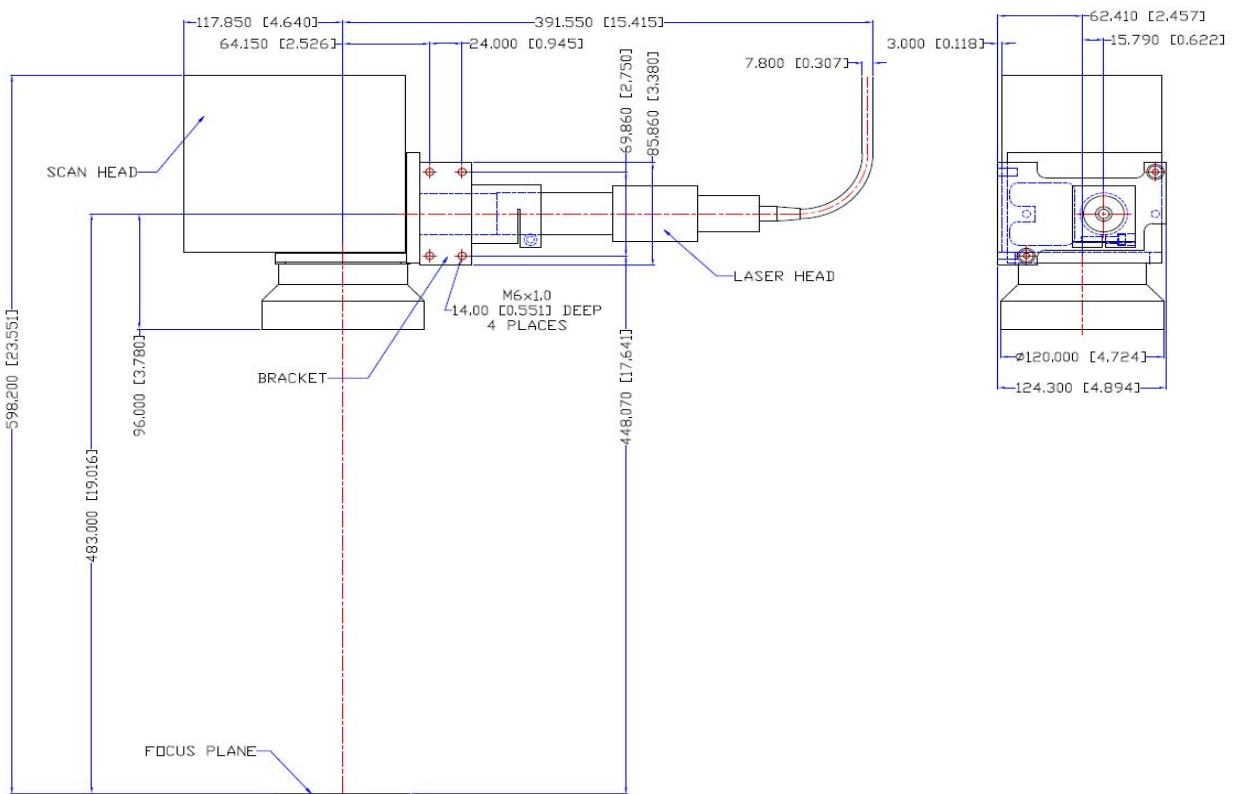
FiberScan™ is the most advanced laser marking software available today. The industry leading, intuitive, easy to use laser marking software suite is available for OEMs and end users.

Windows XP based, network and remote troubleshooting capable FiberScan™ is available for the integrator looking for a richly featured platform flexible enough to support all their marking solutions, or the job shop that demands the highest quality engraving.

Direct parts Marking, product identification, 2D data matrix codes including UID, barcodes, text, graphics, fonts, fills, automation, logos, alpha-numeric serial numbers, date codes, part numbers.

Just about anything you can computer image you can laser mark.

**Scanning Head Assembly**



## Comparable Advantages of Fiber Laser Over Nd:YAG

	20 Watt TEM <sub>00</sub> Fiber Laser	50-100 Watt Multimode (Lamp or Diode) 20 Watt TEM <sub>00</sub> Diode Nd:YAG Laser
<b>Laser System</b> <ul style="list-style-type: none"> <li>• Laser, Power Supplies</li> <li>• Computer, Software</li> <li>• Q-switch RF Driver</li> <li>• Scan Head, Control Cards</li> </ul>	<b>\$47,500</b>	<b>\$55,000 - \$65,000</b>
<b>Reliability</b> MTBF (Mean Time Between Failure)	<b>50,000 to 100,000 Hours</b>	<b>500 to 1,000 Hours (Lamp-pumped) 10,000 to 20,000 Hours (Diode-pumped)</b>
<b>Consumables</b>	<b>\$0</b> Note: Fiber Laser Modules Can Be Repaired – Average Repair Costs Range from \$1,000 to \$5,000 USD	<b>\$2,000 - \$15,000</b> (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 170W 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 and/or</li> <li>• 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>	<b>Up to 50%</b>	<b>2-3% (0.2% with 3x Nd:YAG)</b>
<b>Beam Quality</b>	Round, Concentric Near M <sup>2</sup> =1 (<1.05)	Not symmetric on both axes
<b>Spot Size</b>	Due to the excellent M <sub>2</sub> , <b>spot size is 50% smaller than Nd: YAG. Requires less power</b> 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>	<b>Flexible Cable</b> (up to 50m)	<b>Mirrors, Optical Path</b> Loss of beam quality and significant power drop-off with fiber delivery scan head system
<b>Cooling</b>	<b>Air Cooled</b>	<b>De-ionized (DI) Water</b>
<b>Size</b>	<b>19" Rack Mount Unit</b>	<b>Large Footprint</b>
<b>Chiller</b>	<b>No Chiller necessary up to 200 Watt Q-switched (pulsed) or CW.</b>  <b>Cost: \$0</b>	<b>30x Watt to laser output power</b> <b>Cost: \$5,000 - \$8,000</b> (Replacement Required every 1 – 2 yrs)
<b>Total cost of ownership first year</b>	<b>\$47,539.71</b>	<b>\$99,400.00</b>
<b>You Save first year</b>	<b>\$51,860.29</b>	



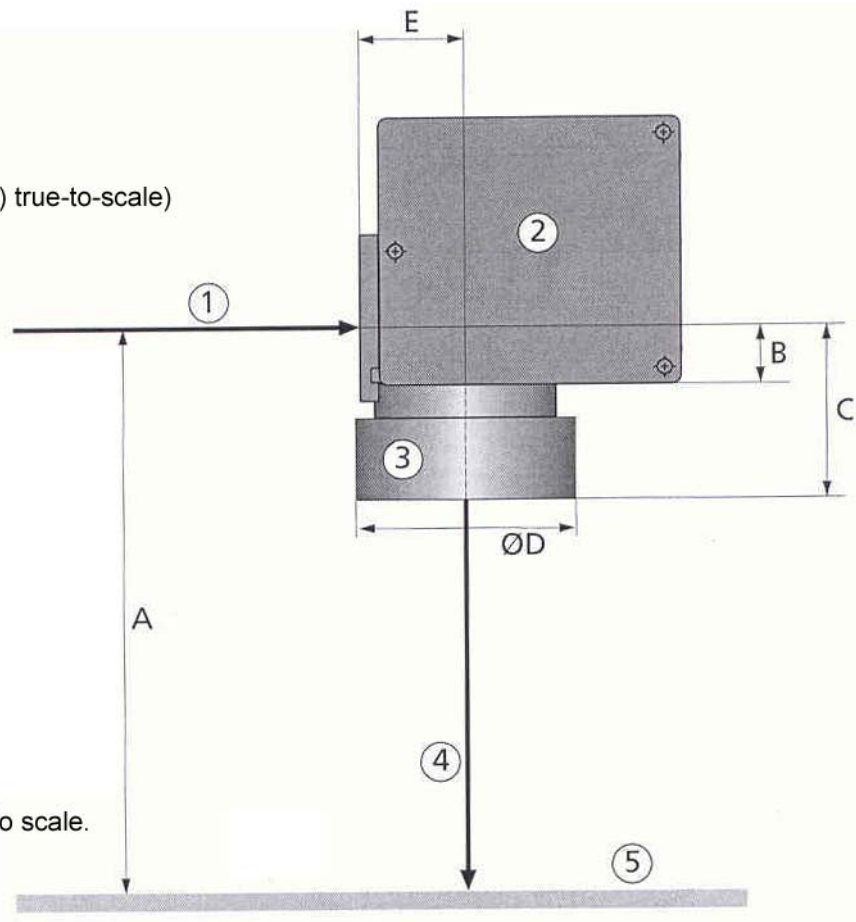
## OEM Fiber Laser Marking System Options

<p><b>Touch Screen Interface</b></p>	
<p><b>4" Or 8" Precision Z-Axis</b></p> <ul style="list-style-type: none"> <li>• Life lubricated preloaded linear slide</li> <li>• Precision ball screw</li> <li>• Dust protective way covers</li> <li>• Contact free home and positioning sensors</li> <li>• Stainless steel cover</li> </ul>	
<p><b>Mounting Hardware</b></p>	
<p><b>Barcode, 2D Data Matrix Code Scanners for Marking Quality Verification</b></p>	
<p><b>Optional Cables, Connectors, and Miscellaneous Electronics</b></p>	
<p><b>Vision System Product Recognition/Alignment System</b></p>	
<p><b>Vision System Marking Quality Verification</b></p>	
<p><b>Optional Scanning Heads</b></p>	
<p><b>Custom Solution and Configuration</b></p>	
<p><b>Customized Beam Shaping Solutions</b></p>	
<p><b>Custom I/O</b></p>	
<p><b>Custom Safety Interface</b></p>	
<p><b>In Line and On the Fly Installations</b></p>	

## Working Distance and Image Field

**Legend**

- 1 Beam entrance
- 2 Scan Head
- 3 Objective (not shown) true-to-scale)
- 4 Emerging beam
- 5 Image Field



Note: Drawing not true to scale.

Objective				A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	Typical image field size [mm <sup>2</sup> ]
SCANLAB part no.	focal length [mm]	laser type	wavelength [nm]						
100824	100	YAG	1064	157	32	60	90	57.15	(59 x 59)
100828	160	YAG	1064	233	32	58	90	57.15	(110 x 110)
100832	254	YAG	1064	390	32	94	120	57.15	(170 x 170)
100834	330	YAG	1064	483	32	96	120	57.15	(230 x 230)
100836	420	YAG	1064	589	32	96	120	57.15	(290 x 290)

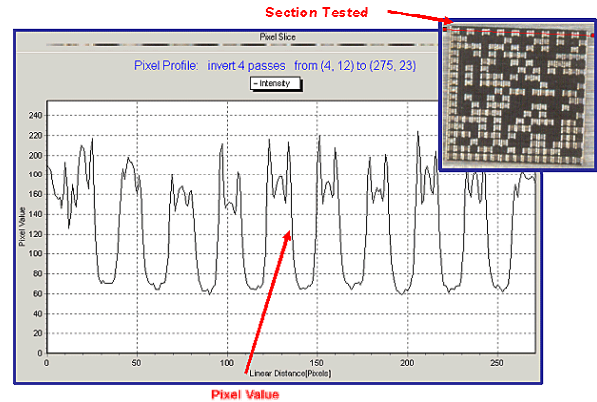
## Application Research Center

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 Software™ (MQA). With our MQA™ Software, we have the ability to guarantee and verify the accuracy and high quality of our marks.

The example above 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 all the different marking processes and types of marks 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.

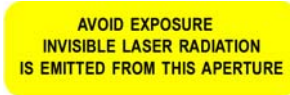
## Article References and Related Technical Documents:

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://ils.pennnet.com/Articles/Article_Display.cfm?Section=Archives&Subsection=Display&ARTICLE_ID=201734&KEYWORD=fiber%20laser%20marking)  
(http://ils.pennnet.com/Articles/Article\_Display.cfm?Section=Archives&Subsection=Display&ARTICLE\_ID=201734&KEYWORD=fiber%20laser%20marking)
5. [Advantages of Fiber vs. YAG lasers](http://www.ptgindustries.com/pdf/FiberYAG.pdf) (http://www.ptgindustries.com/pdf/FiberYAG.pdf)
6. Application Reports
7. Laser Safety

## Additional Available Technical Documents:

- Optional Lens Selection
- Working Distances For Different Lenses
- Full Spectrum Of Fiber Lasers Available
- Laser CCD Height Sensor Specifications
- Scan Head Drawings
- Mounting Hardware Drawings
- Component Dimensional Drawings
- IO Description
- Owners and Installation Manual
- In Line Fiber Laser Marking Kit specifications

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**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 eyewear 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.

**‘Raising the Standard’**



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