Z-LASER
An Exaktera Company

Z-Fiber
High-end fiber laser with active cooling

The ZFSM series has been developed for the most demanding applications in the market. Wherever an exceptional beam quality for high-resolution measurements or medical use is needed, the ZFSM series is the right choice. The user can choose from blue, green and red wavelengths depending on the application requirements.

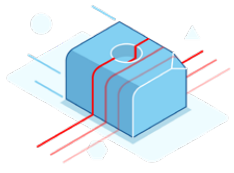
The projection quality is superior to any available free-space solution in the market. The laser along with its intelligent monitoring functions enables a high stability in performance. The integrated active cooling system supports an extended lifetime and stable operation. The laser can be integrated efficiently in a sophisticated machine vision, medical, or life science setup to its communication interfaces (RS-232 & I²C).

IP 67

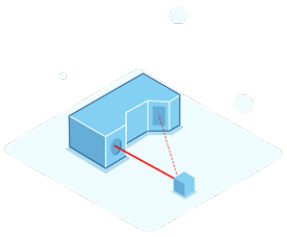
Output Power
up to 35 mW

Highlights

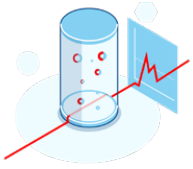
- Single-mode fiber with FC/PC connector
- Unique line uniformity and µ-optics for thin lines
  (<15 µm [1/e²])
- Red, green and blue wavelengths
- Optical output power up to 35 mW
- < 15 µm bei FWHM
- M2 < 1.05
- Analog and simultaneous TTL modulation up to 200 kHz
- Fail-safe for critical applications (e. g. medical)
- OEM-version without housing and TEC (PCB-version)



Machine Vision



Triangulation



Analytics

Order Code

Z??	-	FSM	-	?	-	?	-	?	-	?
Power		Product family Size of head		Electronics		F-Focusable		Wavelength		Optics

System specification

Wavelength	nm	450	520	640	660
Wavelength tolerance	nm (typical)	±10	-5 +10	±5	±5
Wavelength drift	nm (temperature stabilized, over total operating temperature)	< 1			
Output power	mW	≤ 15	≤ 15	≤ 35	≤ 35
Spatial mode	(typical)	Single transversal mode			
RMS noise (20 Hz bis 20 MHz, typical)	%	< 0.5			
Peak-to-Peak Noise (20 Hz bis 20 MHz, typical)	%	< 1			
Boresight error (1)	mrad (typical)	<3			
Pointing stability	µrad / (°C / K)	< 10			
Power stability (1h)	%	< 1			
Start-up time	s	< 5			
Laser operation mode		Power stabilized (integrated TEC)			

Electrical specification

Operating voltage	VDC	5 - 30
Operating current	A	Max. 3
Protection		Over temperature protection and LED pre-failure indicator, reverse polarity and transient protection (ESD, burst & surge)
Electrical isolation		Potential-free housing
Connection		M12 plug 4-pin, Sub-D plug 9-pin
Power consumption	W	< 15
Communication interfaces		I^2C, RS-232

Optical specification

Fan angles (2) µ-optics	° Degrees	10, 20 (homogeneous lines)
Fan angles (2) standard	° Degrees	10, 20, 30, 45, 60, 75 (homogeneous lines)
Line straightness (3)	% (of line length)	< 0.05
Line uniformity (4)	% (typical)	±10
M^2		SM < 1.05
Dot		Circular
Focus range	mm	40 - 150 (µlp) and 150 - 10,000 (lp)
Classification		IEC 60825-1:2014 IEC 60601-2-22 (for laser classes 3R and 3B)

Keynotes

(1) Boresight error	Also known as pitch and skew.
(2) Line length / fan angle	at >13.5 % I_{max}
(3) Line straightness	Deviation from best fit line over the middle 80% of the line, for homogeneous lines
(4) Line uniformity	Maximum relative optical power variation over the middle 80% of the line, for homogeneous lines

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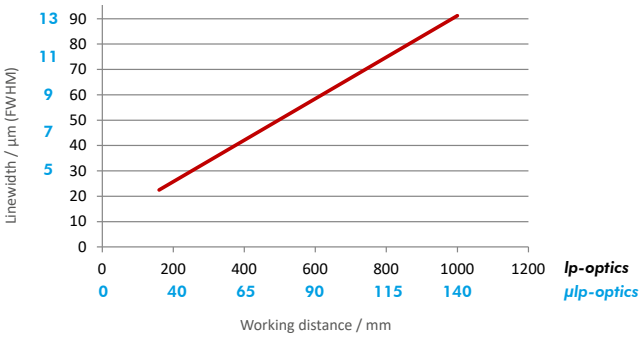
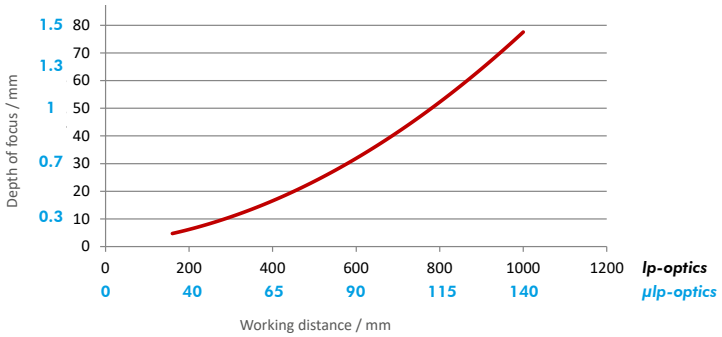
Line width vs. working distance*



DOF vs. working distance*



Wavelength		Calculation factor for line width		Calculation factor for depth of focus	
		µlp	*lp*	*µlp*	*lp*
Blue	450 nm	1.00	1.00	1.00	1.00
Green	520 nm	1.10	1.10	1.10	0.80
Red	640 nm	1.20	1.20	1.20	1.00

- *µlp* = µ-line Powell; very thin lines with smaller depth of focus (only available for fan angles 10° and 20° at working distances < 150 mm)
- *lp* = line Powell; standard setup for working distances > 150 mm

The graphs above show the values for line width and depth of focus of a 450 nm laser. To get the values for a different wavelength the factor from the table above has to be multiplied by the values from the graphs.

Example: 450 nm laser focused at 90 mm working distance:
line width approx. 9 µm (@ *µlp* optic); Depth of focus approx. 0.7 mm (values from the graphs)

Calculated: 640 nm laser focused at 90 mm working distance:
line width approx. 9 µm x 1.20 = 11 µm; Depth of focus approx. 0.7 mm x 1.20 = 0.85 mm

* Values in the graphs for homogenous line profiles

** Fan angle

Software

GUI
Serial communication
I²C and RS-232

Features (e. g.):
Status query
Output power control
System configuration
Digital Modulation
Intensity control
End of life indication

Classification

Software according to IEC 62304

Digital modulation

Maximum frequency	kHz	Up to 20
Rise time (Mod High ➡ 90%)	ns	< 650
Fall time (Mod Low ➡ 10%)	ns	< 350
Signaling levels	V	VIL_max < +1.2 VIH_min > +2.8
Operation range	VDC	0 - 30

Analog modulation

Maximum bandwidth	kHz	< 100
Linearity	%	< 5 (from 10 % to 100 % of laser power)
Active range	VDC	0 - 2
Impedance		100 kΩ to internal VCC (3.3 V)
Operation range	VDC	0 - 30

Environmental conditions

Operating temperature	°C | °F	-10 up to +50 | -14 up to 122 (housed version) 0 up to +50 | 32 up to 122 (PCB-version)
Storage temperature	°C | °F	-20 up to +80 | -4 up to +173
Humidity	%	< 90, non-condensing
Dissipated heat	W	< 15

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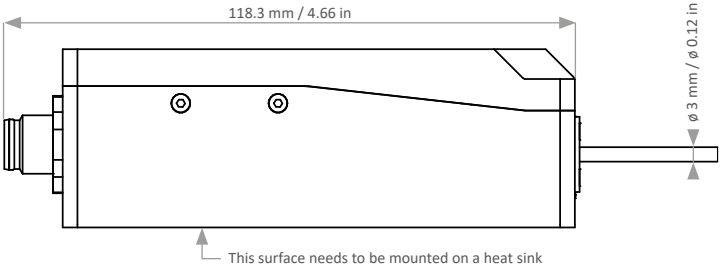
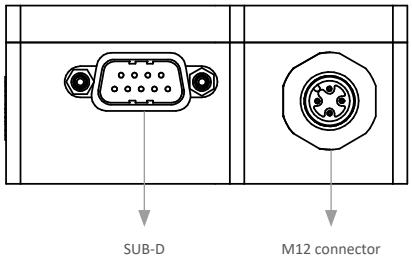
Mechanical Specifications

Weight		
Head	g | lbs	60 | 0.13
Electronics (housed version)	g | lbs	410 | 0.9
Dimensions	mm | inch	Housing 105.25 x 82.5 x 36.6 | 4.14 x 3.25 x 1.44 PCB 70 x 60 | 2.76 x 2.36 (PCB-version) Fiber length 450 | 17.72 (plus FC / PC connector)
Diameter head ø	mm | inch	20 mm | 0,79 in
Material		Aluminum (black anodized)
Protection class		IP 50
Mounting		20 mm mount

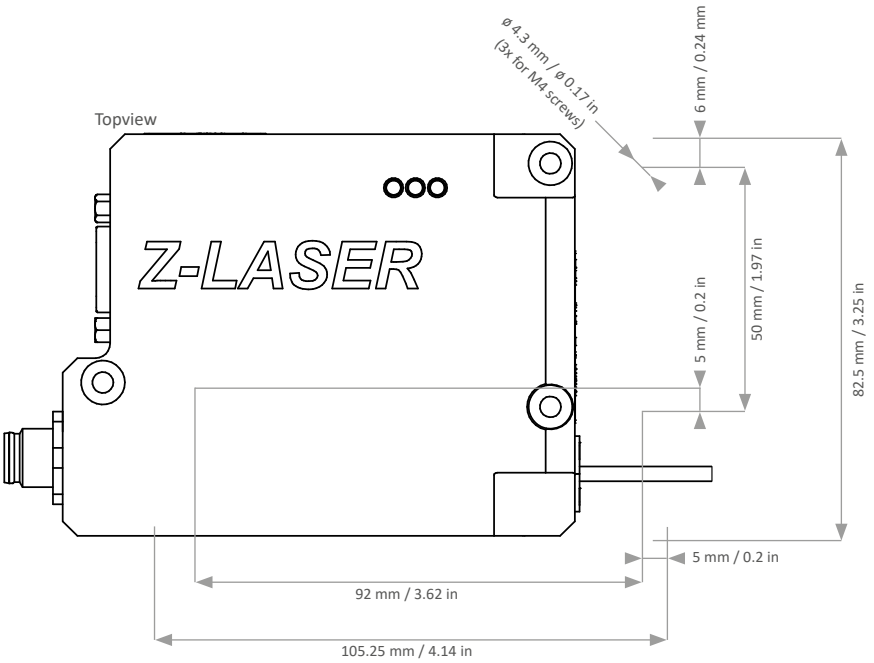
Side view



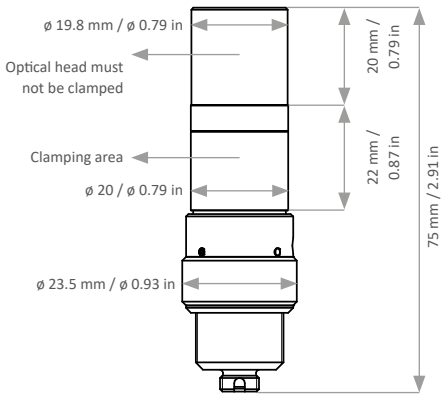
Rear view



Topview

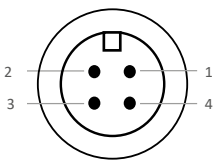


Optical head



M12 4-Pin: A-Coding Male Connector

1	5 - 30 VDC, 20 VA
2	Digital-Modulation TTL
3	GND
4	Analog-Modulation (0-2 VDC)



CE-Conformity according to the directives 2014/30/EU, 2011/65/EU and 2006/25/EU. Subject to technical change. Version: October 2023