

ZFSM-M

Fiber laser for high-end applications

The structured light fiber laser series ZFSM-M has been developed for the most demanding applications in the market. Wherever an exceptional beam performance for high-resolution measurements or medical use is needed, the ZFSM-M series is the right choice. The user can choose from blue, green, red, and near-infrared 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 due to its communication interfaces (RS-232 & I²C).



Wavelength: 450 nm 520 nm 638 - 685 nm 785 - 830 nm



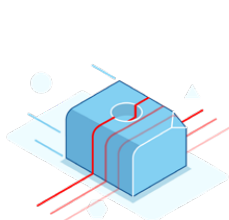
High Process Reliability



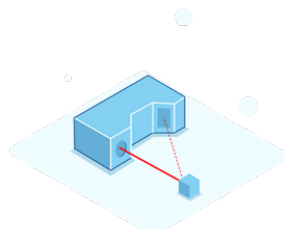
Output Power up to 40 mW

Highlights

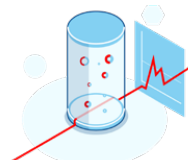
- Single-mode fiber with FC/PC connector
- Unique line uniformity and μ -optics for thin lines (<20 μ m)
- Red, green, blue, and IR wavelengths
- Optical output power up to 40 mW
- M2 ~1.05
- Analog and simultaneous TTL modulation up to 200 kHz



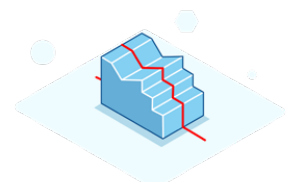
Machine Vision



Triangulation



Analytics



3D-Measurement

Order Code

Z??	FSM	M	?	?	?
Power	Product family Size of head	Electronics	Wavelength	Fiber length (standard 50mm)	Optics

System specification

Wavelength	nm	450 nm	520 nm	635-685 nm	785-830 nm
Wavelength tolerance	nm (typical)	±10 nm	-5 nm +10nm	±5 nm	±10 nm
Wavelength drift	nm (temperature stabilized, over total operating temperature)	< 1 nm			
Output power	mW	≤ 15 mW	≤ 15 mW	≤ 35 mW	≤ 40 mW
Spacial 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 mrad			
Pointing stability	μrad / °C	< 10 μrad / K			
Power stability	(1 h)	< 1 % in steady state			
Start-up time	s	< 5 s			

Electrical specification

Operating voltage	12 - 24 VDC
Operating current	< 120 mA - 12 VDC
Protection	Over temperature protection and LED pre-failure indicator, reverse polarity and transient protection (ESD, burst & surge)
Communication interfaces	I ² C, RS-232
Connection	JST-BM08B-ZESS

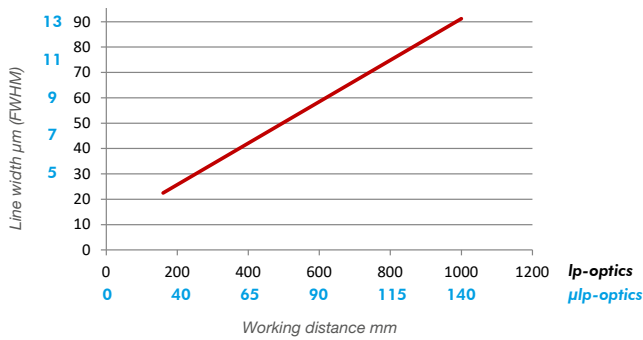
Optical specification

Fan angles (2) μ-optics	Degrees	10°, 20° (homogeneous lines)
Fan angles (2) standard	Degrees	5°, 10°, 20°, 30°, 45°, 60°, 75° (homogeneous lines)
Line straightness (3)	% (of line length)	< 0.05 %
Line uniformity (4)	% (typical)	±25 %
M ²		SM ~1.05
Dot		Circular
Focus range	mm	40 - 150 mm (μlp) and 150 - 10,000 mm (lp)
Classification		IEC 60825-1:2014

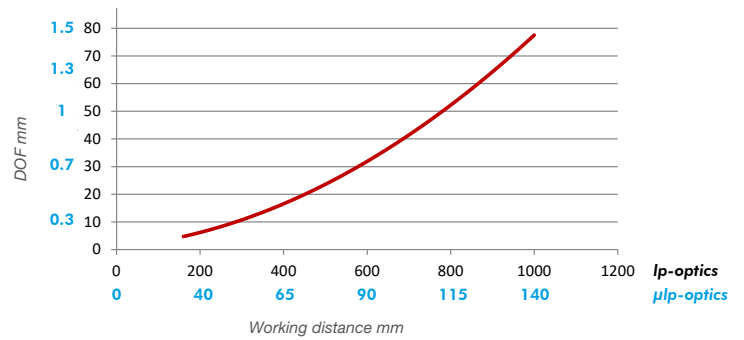
Keynotes

⁽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

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

Digital modulation

Maximum frequency	Up to 200 kHz
Rise time (Mod High ⇒ 90%)	< 650 ns
Fall time (Mod Low ⇒ 10%)	< 350 ns
Signaling levels	V _{IL_max} < +1.2 V V _{IH_min} > +2.8 V
Operation range	5 - 24 VDC (635-685 nm, 785-830 nm) 9 - 24 VDC (450 nm, 520 nm)

Analog modulation

Maximum bandwidth	< 10 Hz
Linearity	< 5 % (from 10 % to 100 % of laser power)
Active range	0 - 2 VDC
Operation range	12 - 24 VDC

Environmental conditions

Operating temperature	°C / °F	-10 °C up to +50 °C / -14 °F up to 122 °F (housed version) 0 °C up to +50 °C / 32 °F up to 122 °F (PCB-version)
Storage temperature	°C / °F	-20 °C up to +80 °C / -4 °F up to +173 °F
Humidity	%	< 90 %, non-condensing
Dissipated heat	W	< 1.5 W

Mechanical Specifications

Weight		
Head	g / lbs	60 g / 0.13 lbs
Electronics (housed version)	g / lbs	410 g / 0.9 lbs
Dimensions		PCB 42 x 30 mm / 1.65 x 1.18 in (PCB-version) Fiber length 450 mm / 17.72 (plus FC / PC connector)
Diameter head ϕ	mm / inch	20 mm / 0,79 in
Material		Aluminum (black anodized)
Protection class		IP 50
Mounting		20 mm mount

