

# Лазеры ZXS20

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# Product Family ZXS

## The flexible laser module

The structured light laser ZXS sets new standards for machine vision illumination due to its automated production in which all optical components are aligned by a high-accuracy robot.

The ZXS-laser reaches an unrivalled accuracy with its boresight error of less than 0.8 mrad.

The separated electronics enables the user to mount the laser individually. An OEM-Version with a customized electronics for the integration onto an existing PCB is also available.



IP 67



Increase Of Work Quality



Boresight Accuracy



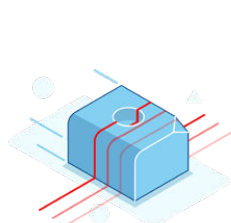
High Process Reliability



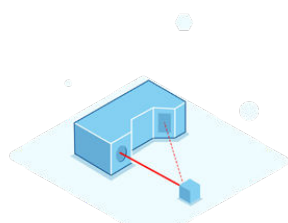
Output Power up to 200 mW

## Highlights

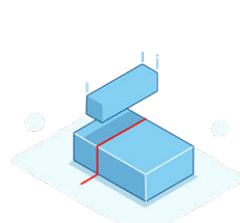
- Industrial standard
- IP 67 (ZXS20) / IP 50 (ZXS10)
- Repeatable product performance due to automated production processes
- Highest reproducibility of beam quality
- Optical output power up to 200 mW
- Wavelengths from 405 – 830 nm
- Manually focusable (ZXS20)
- TTL modulation up to 150 kHz
- Analog intensity control



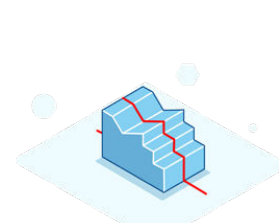
Machine Vision



Triangulation Sensors



High-Precision Positioning Tasks



3D-Measurement

### Order Code

| Power | Product family | Size of head | Electronics | F-Focusable | Wavelength | Optics |
|-------|----------------|--------------|-------------|-------------|------------|--------|
| Z??   | XS20           | ?            | ?           | ?           | ?          | ?      |

## System specifications

|                                                  |                  |
|--------------------------------------------------|------------------|
| Wavelength                                       | nm               |
| Wavelength tolerance                             | nm (typical)     |
| Wavelength drift                                 | nm / K (typical) |
| Available with optical head                      |                  |
| Output power ZXS10                               | mW               |
| Output power ZXS20 (elp)                         | mW               |
| Output power ZXS20 (flp)                         | mW               |
| Spatial mode                                     | (typical)        |
| RMS noise<br>(20 Hz to 20 MHz, typical)          | %                |
| Peak-to-Peak Noise<br>(20 Hz to 20 MHz, typical) | %                |
| Boresight error <sup>(1)</sup>                   | mrad (typical)   |
| Line orientation <sup>(2)</sup>                  | mrad             |
| Pointing stability                               | μrad / K         |
| Long-term power stability (24h)                  | %                |
| Start-up time                                    | sec              |
| Laser operation mode                             |                  |

| 405  | 450  | 520       | 635-685 | 785  | 830  |
|------|------|-----------|---------|------|------|
| ±10  | ±10  | -5<br>+10 | ±10     | ±10  | ±4   |
| 0,06 | 0,02 | 0,06      | 0,25    | 0,25 | 0,25 |

|       |      |      |       |       |       |
|-------|------|------|-------|-------|-------|
| n. a. | ≤ 45 | ≤ 35 | ≤ 100 | ≤ 100 | ≤ 100 |
| ≤ 160 | ≤ 60 | ≤ 40 | ≤ 100 | ≤ 80  | ≤ 200 |
| ≤ 120 | ≤ 45 | ≤ 30 | ≤ 90  | ≤ 60  | ≤ 150 |

### Single Transverse Mode

< 0.5

< 1

< 0.8 (fixed focus)

< 10

< 10

±3 over operating temperature range

< 2

APC

## Electrical specifications

|                                   |     |
|-----------------------------------|-----|
| Operating voltage                 | VDC |
| Operating current (max. at 25 °C) | mA  |
| Protection                        |     |
| Electrical isolation              |     |
| Connection                        |     |
| Power consumption                 | W   |
| Communication interfaces          |     |

| 9 - 30 | 9 - 30 | 9 - 30 | 5 - 30 | 5 - 30 | 5 - 30 |
|--------|--------|--------|--------|--------|--------|
| < 300  | < 300  | < 300  | < 400  | < 500  | < 500  |

Over temperature protection and LED pre-failure indicator, reverse polarity and transient protection (ESD, burst & surge)

Potential-free housing

5-pin M12 plug; cable with flying leads or customized

|       |       |       |     |       |       |
|-------|-------|-------|-----|-------|-------|
| < 2.7 | < 2.7 | < 2.7 | < 2 | < 2.5 | < 2.5 |
|-------|-------|-------|-----|-------|-------|

I<sup>2</sup>C, RS-232 (5 V)

## Optical specification

|                                  |                    |
|----------------------------------|--------------------|
| Fan angles <sup>(3)</sup>        | ° Degrees          |
| Line straightness <sup>(4)</sup> | % (of line length) |
| Line uniformity <sup>(5)</sup>   | % (typical)        |
| Dot                              |                    |
| DOE                              |                    |
| Focus range                      | mm                 |

5, 10, 20, 30, 45, 60, 75, 90 (homogeneous lines)  
3, 5, 10, 15, 20, 30, 90 (Gaussian line profile)

< 0.05

< 25

Point elliptical

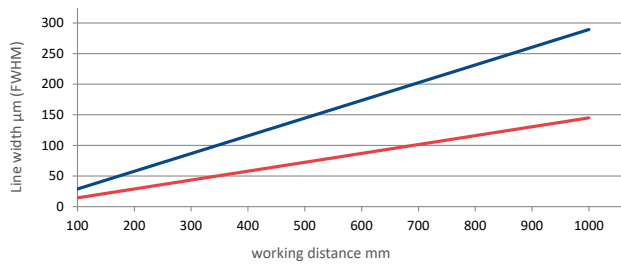
Multi line, crosses, grids, etc.

100 up to 10,000 (or fixed focus available)

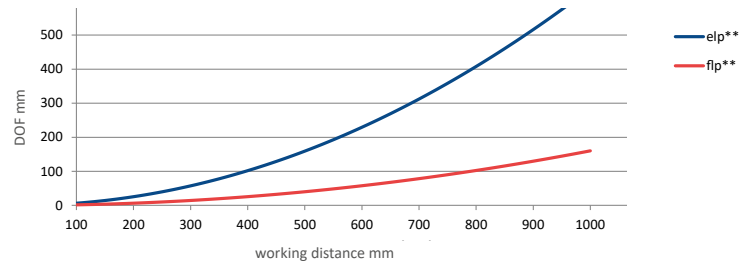
## Keynotes

|                             |                                                                                                                 |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------|
| (1) Boresight error         | Also known as pitch and skew.                                                                                   |
| (2) Line orientation        | Also known as line tilt (roll) with reference to the indentation in the clamping area                           |
| (3) Line length / fan angle | at > 13.5 % I <sub>max</sub>                                                                                    |
| (4) Line straightness       | Deviation from best fit line over the middle 80% of the line, for homogeneous lines                             |
| (5) Line uniformity         | Maximum relative optical power variation over the middle 80% of the line, for homogeneous lines and fixed focus |

## Line width vs. working distance\*



## DOF vs. working distance\*



| Wavelength |        | Calculation factor for line width |       | Calculation factor for depth of focus |       |
|------------|--------|-----------------------------------|-------|---------------------------------------|-------|
|            |        | flp**                             | elp** | flp**                                 | elp** |
| Blue       | 405 nm | 0.66                              | 0.82  | 0.75                                  | 1.02  |
| Blue       | 450 nm | 1.03                              | 1.83  | 1.49                                  | 4.29  |
| Green      | 520 nm | 0.97                              | 1.20  | 0.99                                  | 2.61  |
| Red        | 640 nm | 1.05                              | 1.00  | 1.04                                  | 0.95  |
| Red        | 660 nm | 1.00                              | 1.00  | 1.00                                  | 1.00  |
| IR         | 830 nm | 1.42                              | 2.11  | 1.71                                  | 2.20  |

Optical configurations for several line settings are available.

- flp\*\* = fine line Powell; thin lines for all working distances with smaller depth of focus (recommended for fan angles between 5° - 60° at working distances < 500 mm and for fan angle of 90° at working distances > 500 mm). This optical configuration cannot supply the maximum output mentioned on page 2. Only approx. 75% can be achieved.
- elp\*\* = extended line Powell; lines with advanced depth of focus and thicker lines. Recommended for fan angles > 75° at working distances < 500 mm.

The graphs above show the values for line width and depth of focus of a 660 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: 660 nm laser focused at 500 mm working distance: line width approx. 150 µm (@ elp\*\* optic); Depth of focus approx. 175 mm (values from the graphs)

Calculated: 405 nm laser focused at 500 mm working distance: line width approx. 150 µm x 0.82 = 123 µm; Depth of focus approx. 175 mm x 1.02 = 179 mm

\* Values in the graphs for homogenous line profiles

\*\* Fan angle: 5° - 90°

## Software

GUI  
Serial communication  
I<sup>2</sup>C, RS-232 (5 V)

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

## Digital modulation

|                               |     |                                  |
|-------------------------------|-----|----------------------------------|
| Maximum frequency             | kHz | up to 150                        |
| Rise time<br>(Mod High ⇒ 90%) | ns  | < 160                            |
| Fall time<br>(Mod Low ⇒ 10%)  | ns  | <100                             |
| Signaling levels              | V   | VIL_max < +0.9<br>VIH_min > +2.2 |
| Operation range               | VDC | 0 - 30                           |

## Analog modulation

|                   |     |                                         |
|-------------------|-----|-----------------------------------------|
| Maximum bandwidth | Hz  | < 10                                    |
| 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                                  |

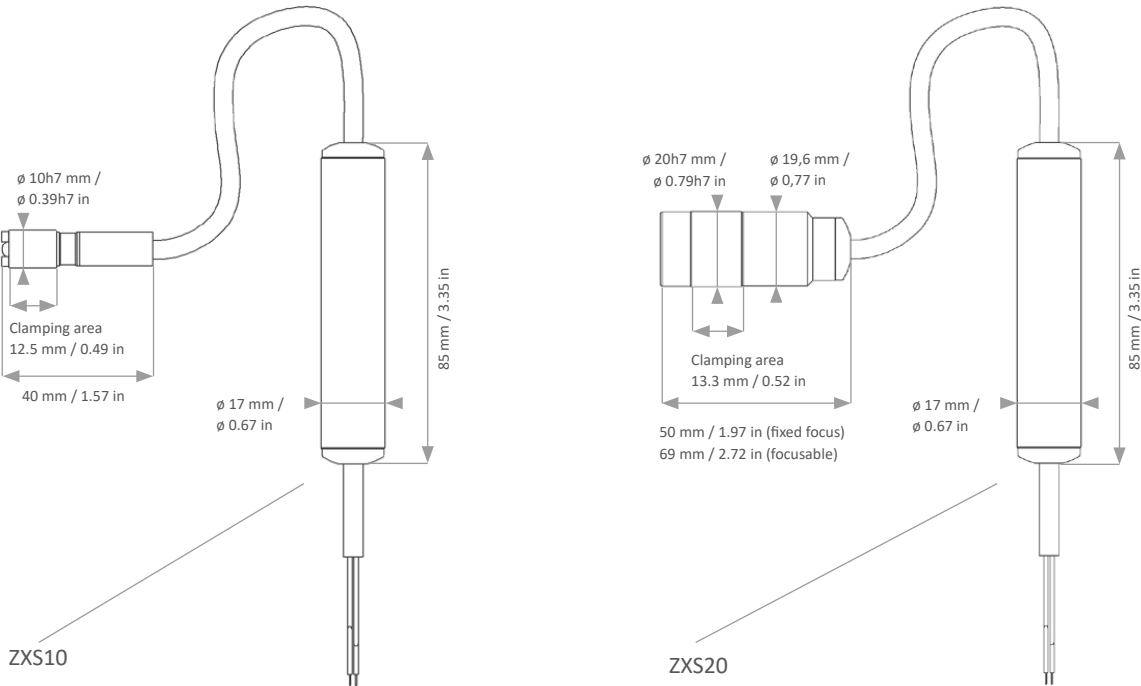
## Environmental conditions

|                       |         |
|-----------------------|---------|
| Operating temperature | °C   °F |
| Storage temperature   | °C   °F |
| Humidity              | %       |
| Dissipated heat       | W       |
| Shock and vibration   |         |

|                                        |
|----------------------------------------|
| -10 to +50   14 to +122                |
| -40 to +85   40 to +185                |
| < 90, non-condensing                   |
| Max. 4                                 |
| According to IEC EN 61373:2011, cat. 2 |

Mechanical Specifications - DEPENDING ON LASER HEAD VERSION

|                                                |           |                                                                  |                           |                             |
|------------------------------------------------|-----------|------------------------------------------------------------------|---------------------------|-----------------------------|
| Weight                                         | g / lbs   | ZXS10<br>140 g / 0.09 lbs                                        | ZXS20<br>180 g / 0.39 lbs | ZXS20-F<br>220 g / 0.49 lbs |
| Length                                         | mm / inch | please see technical drawing below                               |                           |                             |
| Diameter head $\varnothing$                    | mm / inch | please see technical drawing below                               |                           |                             |
| Length of cable between optics and electronics | mm / inch | 100 mm / 3.53 in (others on request)                             |                           |                             |
| Length of connection cable                     | mm / inch | 1,000 mm / 39.37 in (others on request)                          |                           |                             |
| Material                                       |           | Stainless steel (laser head) / aluminum (housing of electronics) |                           |                             |
| Protection class                               |           | IP 50 (IP 67 optional)                                           | IP 67                     | IP 67                       |



6-lead cable

|              |                                       |                                       |
|--------------|---------------------------------------|---------------------------------------|
| X 1.1 brown  | 405 nm - 520 nm:<br>9 - 30 VDC, 15 VA | 635 nm - 830 nm:<br>5 - 30 VDC, 15 VA |
| X 1.2 orange | Digital modulation TTL                |                                       |
| X 1.3 black  | GND                                   |                                       |
| X 1.4 yellow | Analog modulation (0-2 VDC)           |                                       |
| X 1.5 green  | Fail out (open-drain)                 |                                       |
| X 1.6 red    | Shielding                             |                                       |

Coding scheme shows default configuration at delivery, individual setup possible.

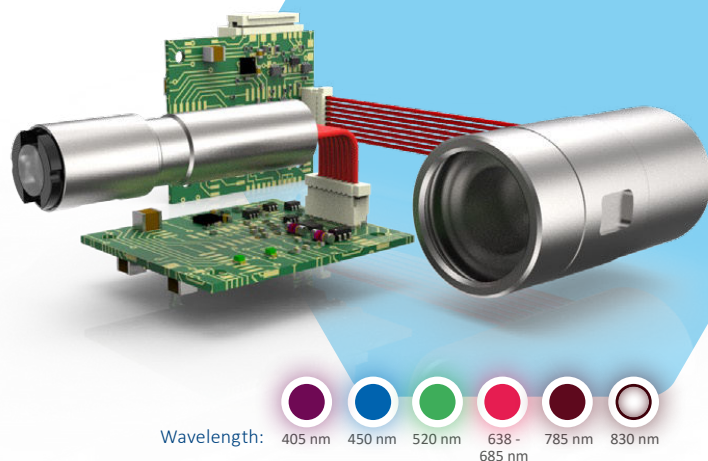
# Product Family ZXS-OEM

## The optimal laser for sophisticated triangulation sensors

The structured light laser ZXS sets new standards for machine vision illumination due to its automated production in which all optical components are aligned by a high-accuracy robotic process.

The focusing optics achieves a boresight error of less than 0.8 mrad

The separated electronics enables the user to mount the laser individually. An OEM-Version with a customized electronics for the integration onto an existing PCB is also available.



Boresight Accuracy



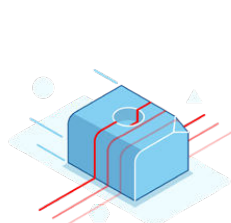
High Process Reliability



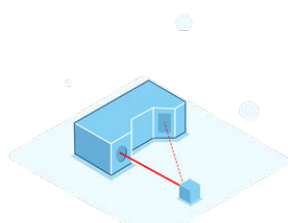
Output Power up to 200 mW

## Highlights

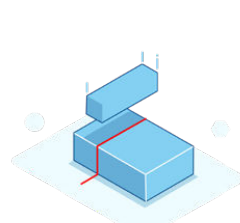
- Industrial standard
- Repeatable product performance due to automated production processes
- Highest reproducibility of beam quality
- Optical output power up to 200 mW
- Wavelengths from 405 – 830 nm
- Manually focusable (ZXS20)
- TTL modulation up to 150 kHz
- Analog intensity control



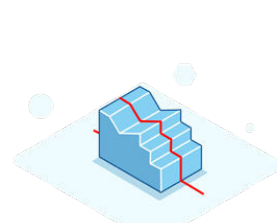
Machine Vision



Triangulation Sensors



High-Precision Positioning Tasks



3D-Measurement

### Order Code

| Power | Product family | Size of head | Electronics | F-Focusable | Wavelength | Optics |
|-------|----------------|--------------|-------------|-------------|------------|--------|
| Z??   | XS20           | ?            | ?           | ?           | ?          | ?      |

System specifications

|                                                  |                  |
|--------------------------------------------------|------------------|
| Wavelength                                       | nm               |
| Wavelength tolerance                             | nm (typical)     |
| Wavelength drift                                 | nm / K (typical) |
| Output power ZXS10                               | mW               |
| Output power ZXS20 (elp)                         | mW               |
| Output power ZXS20 (flp)                         | mW               |
| Spatial mode                                     | (typical)        |
| RMS noise<br>(20 Hz to 20 MHz, typical)          | %                |
| Peak-to-Peak Noise<br>(20 Hz to 20 MHz, typical) | &                |
| Boresight error <sup>(1)</sup>                   | mrad (typical)   |
| Line orientation <sup>(2)</sup>                  | mrad             |
| Pointing stability                               | µrad / K         |
| Long-term power stability (24h)                  | %                |
| Start-up time                                    | sec              |
| Laser operation mode                             |                  |

Electrical specifications

|                                   |     |
|-----------------------------------|-----|
| Operating voltage                 | VDC |
| Operating current (max. at 25 °C) | mA  |
| Protection                        |     |
| Electrical isolation              |     |
| Connection                        |     |
| Power consumption                 | W   |
| Communication interfaces          |     |
|                                   |     |

Optical specifications

|                                             |                    |
|---------------------------------------------|--------------------|
| Fan angles <sup>(3)</sup>                   | Degrees °          |
| Line straightness <sup>(4)</sup>            | % (of line length) |
| Line uniformity <sup>(5)</sup>              | % (typical)        |
| Dot                                         |                    |
| DOE                                         |                    |
| Focus range (only available as fixed focus) | mm                 |

| 405   | 450  | 520       | 640   | 660   | 685   | 785   | 830   |
|-------|------|-----------|-------|-------|-------|-------|-------|
| ±10   | ±10  | -5<br>+10 | ±10   | ±10   | ±10   | ±10   | ±4    |
| 0,06  | 0,02 | 0,06      | 0,25  | 0,25  | 0,25  | 0,25  | 0,25  |
| n. a. | ≤ 45 | ≤ 35      | ≤ 100 | ≤ 100 | ≤ 100 | ≤ 100 | ≤ 100 |
| ≤ 160 | ≤ 60 | ≤ 40      | ≤ 70  | ≤ 160 | ≤ 40  | ≤ 80  | ≤ 200 |
| ≤ 120 | ≤ 45 | ≤ 30      | ≤ 120 | ≤ 120 | ≤ 120 | ≤ 90  | ≤ 150 |

|                                     |
|-------------------------------------|
| Single Transverse Mode              |
| < 0.5                               |
| < 1 %                               |
| < 0.8 (fixed focus)                 |
| < 10                                |
| < 10                                |
| ±3 over operating temperature range |
| < 2                                 |
| APC                                 |

| 9 - 30 | 9 - 30 | 9 - 30 | 5 - 30 | 5 - 30 | 5 - 30 | 5 - 30 | 5 - 30 |
|--------|--------|--------|--------|--------|--------|--------|--------|
| < 300  | < 300  | < 300  | < 500  | < 500  | < 500  | < 500  | < 500  |

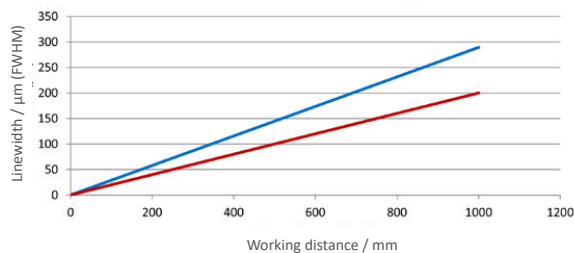
|                                                                                                                           |       |       |       |       |       |       |       |
|---------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|
| Over temperature protection and LED pre-failure indicator, reverse polarity and transient protection (ESD, burst & surge) |       |       |       |       |       |       |       |
| Potential-free housing                                                                                                    |       |       |       |       |       |       |       |
| JST-BM08B-ZESS-TBT                                                                                                        |       |       |       |       |       |       |       |
| < 2.7                                                                                                                     | < 2.7 | < 2.7 | < 2.5 | < 2.5 | < 2.5 | < 2.5 | < 2.5 |
| I <sup>2</sup> C, RS-232 (5 V)                                                                                            |       |       |       |       |       |       |       |
|                                                                                                                           |       |       |       |       |       |       |       |

|                                  |                        |                    |
|----------------------------------|------------------------|--------------------|
| 5, 10                            | 20, 30, 45, 60, 75, 90 | (homogeneous line) |
| < 0.08                           | < 0.05                 |                    |
| < 25                             |                        |                    |
| Point elliptical                 |                        |                    |
| Multi line, crosses, grids, etc. |                        |                    |
| < 100 up to 10,000               |                        |                    |
| < 100 up to 980 (5° fan angle)   |                        |                    |

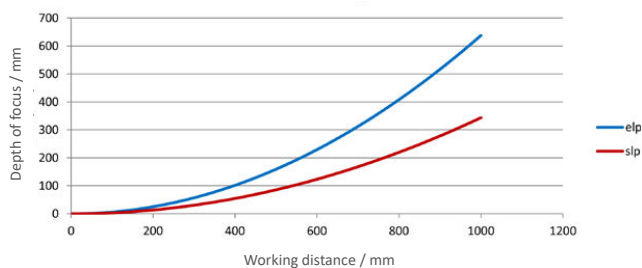
Keynotes

|                             |                                                                                                                 |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------|
| (1) Boresight error         | Also known as pitch and skew.                                                                                   |
| (2) Line orientation        | Also known as line tilt (roll) with reference to the indentation in the clamping area                           |
| (3) Line length / fan angle | at > 13.5 % Imax                                                                                                |
| (4) Line straightness       | Deviation from best fit line over the middle 80% of the line, for homogeneous lines                             |
| (5) Line uniformity         | Maximum relative optical power variation over the middle 80% of the line, for homogeneous lines and fixed focus |

## Line thickness vs. working distance\*



## DOF vs. working distance\*



| Wavelength |        | Calculation factor for line width |            | Calculation factor for depth of focus |            |
|------------|--------|-----------------------------------|------------|---------------------------------------|------------|
|            |        | <i>slp</i>                        | <i>elp</i> | <i>slp</i>                            | <i>elp</i> |
| Blue       | 405 nm | 0.62                              | 0.82       | 0.70                                  | 1.02       |
| Blue       | 450 nm | 0.67                              | 1.83       | 1.74                                  | 4.29       |
| Green      | 520 nm | 0.78                              | 1.20       | 0.80                                  | 2.61       |
| Red        | 640 nm | 1.28                              | 1.00       | 1.70                                  | 0.95       |
| Red        | 660 nm | 1.00                              | 1.00       | 1.00                                  | 1.00       |
| Red        | 685 nm | 1.68                              | 1.40       | 1.97                                  | 1.99       |
| IR         | 830 nm | 1.30                              | 2.11       | 1.03                                  | 2.20       |

Optical configurations for several line settings are available.

- *slp* = standard line Powell; standard setup with medium line thickness and depth of focus.

- *elp* = extended line Powell; lines with advanced depth of focus and thicker lines. Recommended for fan angles > 75° at working distances < 500 mm.

The graphs above show the values for line width and depth of focus of a 660 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: 660 nm laser focused at 500 mm working distance: line width approx. 150 µm (@ *elp* optic); Depth of focus approx. 175 mm (values from the graphs)

Calculated: 405 nm laser focused at 500 mm working distance: line width approx. 150 µm x 0.82 = 123 µm; Depth of focus approx. 175 mm x 1.02 = 179 mm

\* Values in the graphs for homogenous line profiles

\*\* Fan angle: 10° - 90°

## Software

GUI  
Serial communication  
I<sup>2</sup>C, RS-232 (5 V)

Features (e. g.):

- Status query
- Output power control
- System configuration
- Digital Modulation
- Intensity control
- Weighted end of life indication

## Digital modulation

|                               |     |                                                          |
|-------------------------------|-----|----------------------------------------------------------|
| Maximum frequency             | kHz | up to 150                                                |
| Rise time<br>(Mod High ⇒ 90%) | ns  | < 160                                                    |
| Fall time<br>(Mod Low ⇒ 10%)  | ns  | <100                                                     |
| Signaling levels              | V   | V <sub>IL_max</sub> < +0.9<br>V <sub>IH_min</sub> > +2.2 |
| Operation range               | VDC | 0 - 30                                                   |

## Analog modulation

|                   |     |                                         |
|-------------------|-----|-----------------------------------------|
| Maximum bandwidth | Hz  | < 10                                    |
| 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 |
| Storage temperature   | °C / °F |
| Humidity              | %       |
| Dissipated heat       | W       |

-10 °C to +50 °C / 14 °F to +122 °F

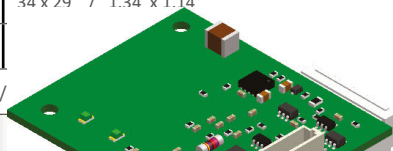
-40 °C to +85 °C / -40 °F to +185 °F

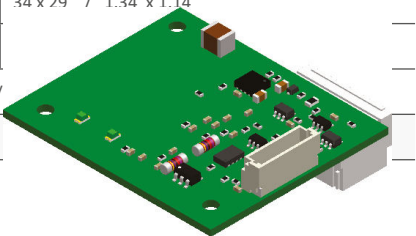
< 90 %, non-condensing

Max. 4 W



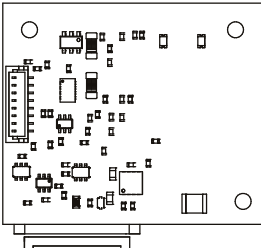
Mechanical Specifications - DEPENDING ON LASER HEAD VERSION

|                                                |           |                                |                                                                                     |                          |  |
|------------------------------------------------|-----------|--------------------------------|-------------------------------------------------------------------------------------|--------------------------|--|
| Length optic head                              | mm / inch | ZXS10-OEM<br>40 / 1.57         | ZXS20-OEM<br>38 / 1.5                                                               | ZXS20-F-OEM<br>98 / 3.86 |  |
| Diameter head $\varnothing$                    | mm        | $\varnothing$ 10h7             | $\varnothing$ 20h7                                                                  | $\varnothing$ 20h7       |  |
| Length of cable between optics and electronics | mm / inch | 100 / 3.53 (others on request) |                                                                                     |                          |  |
| Driver electronics                             | mm / inch | 34 x 33 / 1.34 x 1.3           | 34 x 29 / 1.34 x 1.14                                                               |                          |  |
|                                                |           | with connector                 |  |                          |  |
| Material                                       |           | Stainless steel (laser head) / |                                                                                     |                          |  |
| Protection class                               |           | IP 50 (IP 67 optional)         |                                                                                     |                          |  |

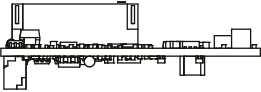


Driver electronics

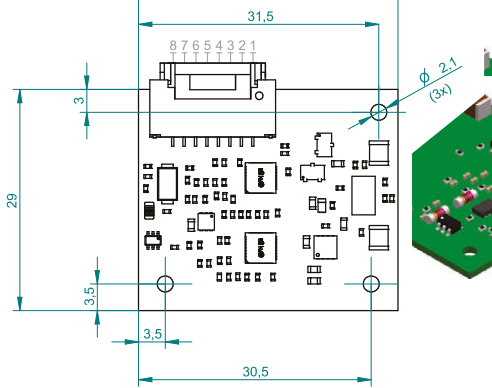
Top-View



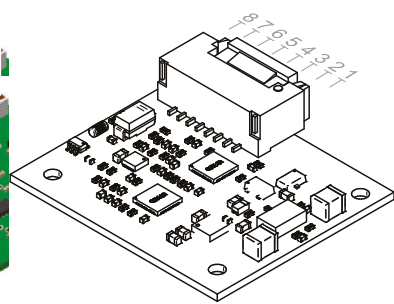
Side-View



Bottom-View



Bottom-View isometric



PinOut driver electronics

|   |        |             |                                                      |
|---|--------|-------------|------------------------------------------------------|
| 1 | Black  | GND         | Ground                                               |
| 2 | Red    | V_IN        | 5...30 VDC (635...830 nm), 9...30 VDC (405...520 nm) |
| 3 | Brown  | UART_RXD    | Laser Out, Master In                                 |
| 4 | Yellow | Analog Mod  | Analog voltage (0...5 VDC)                           |
| 5 | Purple | Digital Mod | Digital Modulation TTL (3,3...30V, active high)      |
| 6 | Black  | UART_TXD    | Laser In, Master Out                                 |
| 7 | Green  | SDA         | TWI-Signal (I <sup>2</sup> C): Serial Data           |
| 8 | White  | SCL         | TWI-Signal (I <sup>2</sup> C): Serial Clock          |

Z-LASER

Z-LASER  
Z-LASER

PinOut 6-lead cable without driver electronics

|   |        |                                       |                                       |
|---|--------|---------------------------------------|---------------------------------------|
| 1 | brown  | 405 nm - 520 nm:<br>9 - 30 VDC, 15 VA | 635 nm - 830 nm:<br>5 - 30 VDC, 15 VA |
| 2 | orange | Digital modulation TTL                |                                       |
| 3 | black  | GND                                   |                                       |
| 4 | yellow | Analog modulation (0-2 VDC)           |                                       |
| 5 | green  | Fail out (open-drain)                 |                                       |
| 6 | red    | Shielding                             |                                       |

Coding scheme shows default configuration at delivery, individual setup possible.

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