



# **Fiber-Coupled Laser**

Monocrom @FLEX Direct Diode

## Features:

- Clamping<sup>™</sup> Patented Technology (Solder free mounting of laser bars)
- Long lifetime
- High reliability
- Low thermal resistances
- Wide storage temperature 40° C to + 85° C
- No SMILE effect

## Suitable for:

- Marking
- Polymer welding
- Direct Ho pumping

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- Medical
- Research

## Monocrom @FLEX Direct Diode

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## Monocrom @FLEX Direct Diode - @FLEX-6





## Monocrom @FLEX Direct Diode - @FLEX-10













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# Monocrom @FLEX Direct Diode I TECH Specifications

Wavelength® [nm]         2100           Linewidth® [nm]         < 15         15-19           Optical power (unpolarized) [M]         35         60         106           Optical power (unpolarized) [M]         18         32         54         95           Coupling afficiency of unpol. light to 600 / 400 µm fiber         > 95% / > 90%         Pepetition rate <sup>m</sup> CW - 10 kHz           Pulse width <sup>(n)</sup> 50 µs - CW         Power stability         < 1% ms         CM - 10 kHz           Pulse to pulse stability         < 1% ms         CM - 10 kHz         Pulse to pulse stability         < 1% ms           Optics          < 1% ms         CM - 10 kHz         Pulse to pulse stability         < 1% ms           Operating voltage <sup>(n)</sup> (M         < 5         < 9         < 18         < 35           Optics          < 9              Operating voltage <sup>(n)</sup> (M         < 5         < 9         < 18         < 35           Divergence without fiber (mrad)         10 (FA) / 15 (SA)         Eesem size without fiber (mm x mm]         12 × 6           Fiber connector type <sup>(n)</sup> HP-SMA-906 [ D80   D80   OBH         Eesem quality BPP <sup>(n)</sup> (# 400 µm (mm mrad]         # 44         Eesem quality BPP <sup>(n)</sup> (# 600 µm (mm mrad]         20	Laser Parameters <sup>(1,2,3,4)</sup>	@FLEX-2	@FLEX-4	@FLEX-6	@FLEX-10
Optical power (inpolarized) [W]         35         60         105           Optical power (inpolarized) [W]         18         32         54         95           Coupling efficiency of unpol. light to 600 / 400 µm fiber         > 95% / > 90%         Fereition rate <sup>01</sup> CW - 10 kHz           Pulse width <sup>07</sup> $50 \mu$ - CW         10 kHz         Fereition rate <sup>01</sup> CW - 10 kHz           Pulse width <sup>07</sup> $50 \mu$ - CW         1% @ 8 h         Fereition rate <sup>01</sup> CW - 10 kHz           Power stability         < 1% @ 8 h	Wavelength <sup>(5)</sup> [nm]	2100			
Optical power (linearly polarized) (M)         18         32         54         95           Coupling efficiency of unpol. light to 600 / 400 µm fiber         > 95% / > 90%         Repetition rate <sup>70</sup> CW - 10 kHz           Pulse width <sup>70</sup> 50 µs - CW         70 kHz         S0 µs - CW           Power stability         < 1% @ 8 h	Linewidth <sup>(6)</sup> [nm]	< 15 15-19			
Coupling efficiency of unpol. light to 600 / 400 µm fiber         > 95% / > 90%           Repetition rate <sup>/n</sup> CW - 10 kHz           Pulse width <sup>0</sup> ?         50 µs - CW           Power stability         < 1% @ 8 h	Optical power (unpolarized) [W]		35	60	105
Repetition rate <sup>(n)</sup> CW - 10 kHz           Pulse width <sup>(n)</sup> 50 µs - CW           Power stability         < 1% @ 8 h	Optical power (linearly polarized) [W]	18	32	54	95
Pulse width <sup>77</sup> 50 μs - CW           Power stability         < 1% @ 8 h	Coupling efficiency of unpol. light to 600 / 400 $\mu m$ fiber	> 95% / > 90%			
Power stability         <1% Ø 8 h	Repetition rate <sup>(7)</sup>	CW – 10 kHz			
Pulse to pulse stability         < 1% ms           Optics            Operating voltage® [M]         < 5	Pulse width <sup>(7)</sup>	50 µs – CW			
OpticsOperating voltage <sup>(II)</sup> [M]<5	Power stability	< 1% @ 8 h			
Operating voltage® [M]< 5< 9< 18< 35Threshold current [A]< 9	Pulse to pulse stability	< 1% rms			
Threshold current [A]< 9Operating current [A]< 85	Optics				
Operating current [A]< 85Divergence without fiber® [mrad]10 (FA) / 15 (SA)Beam size without fiber [mm x mm] $12 \times 6$ Fiber connector type <sup>(10)</sup> HP-SMA-905 [ D80 ] OBHBeam quality BPP <sup>11)</sup> @ 400 µm [mm mrad]44Beam quality BPP <sup>11)</sup> @ 600 µm [mm mrad] $67$ Pointing stability @ fixed power [µrad] $\pm 50$ Operating Parameters <sup>(12)</sup> Coolant flow [/min] $1.2$ $2.5$ $5$ Coolant flow [/min] $1.2$ $2.5$ $5$ $10$ Coolant pressure [bar] $< 3.5$ bar $< 3.5$ barCoolant temperature [°C] $20 - 25$ $20 - 25$ Recommended coolant $90\%$ DI water + $10\%$ ethylene glycol $Warm$ up time [min] $< 2$ Operating temperature [°C]non-condensing - $55$ $SUB-D-25$ $2x$ SUB-D-15 SUB-D-25BedyElectrical connectionsSeries 702 Binder $SUB-D-25$ $2x$ SUB-D-15 SUB-D-25Driver electronicsexternal 19-inch rack mountWeight [kg] $< 0.5$ $< 5$ $< 15$ $< 25$ Laser head dimensions (L $\times W \times H$ ) [mm²] $125 \times 52 \times 52$ $140 \times 250 \times 123$ $280 \times 270 \times 123$ $415 \times 375 \times 148$ Laser class product (EN-60825) $4$	Operating voltage <sup>(8)</sup> [V]	< 5	< 9	< 18	< 35
Divergence without fiber® [mrad]       10 (FA) / 15 (SA)         Beam size without fiber [mm × mm]       12 × 6         Fiber connector type <sup>(10)</sup> HP-SMA-905   D80   QBH         Beam quality BPP <sup>(11)</sup> @ 400 µm [mm mrad]       44         Beam quality BPP <sup>(11)</sup> @ 600 µm [mm mrad]       67         Pointing stability @ fixed power [µrad]       ± 50         Operating Parameters <sup>(12)</sup> Coolant flow [/min]       1.2       2.5       5       10         Coolant flow [/min]       1.2       2.5       5       10         Coolant temperature [°C]       20 - 25       5       10         Recommended coolant       90% DI water + 10% ethylene glycol       Warm up time [min]       < 2	Threshold current [A]	< 9			
Beam size without fiber [mm × mm]         12 × 6           Fiber connector type <sup>fr0</sup> HP-SMA-905 [ D80 ] QBH           Beam quality BPP <sup>11)</sup> @ 400 µm [mm mrad]         44           Beam quality BPP <sup>11)</sup> @ 600 µm [mm mrad]         67           Pointing stability @ fixed power [µrad]         ± 50           Operating Parameters <sup>129</sup> 5           Coolant flow [l/min]         1.2         2.5         5         10           Coolant pressure [bar]         < 3.5 bar	Operating current [A]	< 85			
Fiber connector type <sup>10</sup> HP-SMA-905   D80   QBH         Beam quality BPP <sup>11</sup> @ 400 µm [mm mrad]       44         Beam quality BPP <sup>11</sup> @ 600 µm [mm mrad]       67         Pointing stability @ fixed power [µrad]       ± 50         Operating Parameters <sup>119</sup> Coolant flow [/min]       1.2       2.5       5       10         Coolant pressure [bar]       < 3.5 bar	Divergence without fiber <sup>(9)</sup> [mrad]	10 (FA) / 15 (SA)			
Beam quality BPP <sup>(1)</sup> @ 400 µm [mm mrad]       44         Beam quality BPP <sup>(1)</sup> @ 600 µm [mm mrad]       67         Pointing stability @ fixed power [µrad]       ± 50         Operating Parameters <sup>(1,2)</sup> Coolant flow [/min]       1.2       2.5       5       10         Coolant pressure [bar]       < 3.5 bar	Beam size without fiber [mm × mm]	12 × 6			
Beam quality BPP <sup>111</sup> @ 600 µm [mm mrad]       67         Pointing stability @ fixed power [µrad]       ± 50         Operating Parameters <sup>(12)</sup> Coolant flow [/min]       1.2       2.5       5       10         Coolant pressure [bar]       < 3.5 bar	Fiber connector type <sup>(10)</sup>	HP-SMA-905   D80   QBH			
Pointing stability @ fixed power [µrad] $\pm 50$ Operating Parameters <sup>(12)</sup> Coolant flow [/min]1.22.5510Coolant pressure [bar]<3.5 bar	Beam quality BPP <sup>(11)</sup> @ 400 µm [mm mrad]	44			
Operating Parameters <sup>(12)</sup> 1.2         2.5         5         10           Coolant flow [l/min]         1.2         2.5         5         10           Coolant pressure [bar]         < 3.5 bar	Beam quality BPP <sup>(11)</sup> @ 600 µm [mm mrad]	67			
Coolant flow [l/min]         1.2         2.5         5         10           Coolant pressure [bar]         < 3.5 bar	Pointing stability @ fixed power [µrad]	± 50			
Coolant pressure [bar]< 3.5 barCoolant temperature [°C] $20-25$ Recommended coolant90% DI water + 10% ethylene glycolWarm up time [min] $< 2$ Operating temperature [°C]non-condensing - 55BodyElectrical connectionsSeries 702 BinderSUB-D-25 $2^{x}$ SUB-D-15 SUB-D-25Driver electronics $< 0.5 < 5 < 15 < 25$ $< 25$ User head dimensions (L × W × H) [mm³] $125 \times 52 \times 52$ $140 \times 250 \times 123$ $280 \times 270 \times 123$ $415 \times 375 \times 148$ $415 \times 375 \times 148$	Operating Parameters <sup>(12)</sup>				
20 - 25Recommended coolant $90\%$ DI water + 10% ethylene glycolWarm up time [min] $< 2$ Operating temperature [°C]non-condensing - 55BodyElectrical connectionsSeries 702 BinderSUB-D-25 $2x$ SUB-D-15 SUB-D-25Driver electronics $external 19$ -inch rack mountVeight [kg] $< 0.5$ $< 5$ $< 15$ $< 25$ Laser head dimensions (L × W × H) [mm³] $125 \times 52 \times 52$ $140 \times 250 \times 123$ $280 \times 270 \times 123$ $415 \times 375 \times 148$ Laser class product (EN-60825) $4$ $4$	Coolant flow [l/min]	1.2	2.5	5	10
Recommended coolant $90\%$ DI water + 10% ethylene glycolWarm up time [min] $< 2$ Operating temperature [°C]non-condensing – 55Body $Electrical connectionsSeries 702BinderSUB-D-252x SUB-D-15SUB-D-25Driver electronicsexternal 19-inch rack mountVeight [kg]< 0.5< 15< 25Laser head dimensions (L × W × H) [mm³]125 \times 52 \times 52140 \times 250 \times 123280 \times 270 \times 123415 \times 375 \times 148Laser class product (EN-60825)4$	Coolant pressure [bar]	< 3.5 bar			
Warm up time [min]       <2	Coolant temperature [°C]	20 – 25			
Operating temperature [°C]non-condensing – 55BodySeries 702 Binder $SUB - 25$ $2x SUB - D - 15$ SUB - D - 25Driver electronicsexternal 19 - inch rack mount $v = 10 - 25$ $v = 10 - 25$ Weight [kg] $< 0.5$ $< 5$ $< 15$ $< 25$ Laser head dimensions (L × W × H) [mm³] $125 \times 52 \times 52$ $140 \times 250 \times 123$ $280 \times 270 \times 123$ $415 \times 375 \times 148$ Laser class product (EN-60825) $4$ $4$ $4$	Recommended coolant	90% DI water + 10% ethylene glycol			
BodyElectrical connectionsSeries 702 BinderSUB-D-252x SUB-D-15 SUB-D-25Driver electronicsexternal 19-inch rack mountWeight [kg]< 0.5	Warm up time [min]	< 2			
Electrical connections         Series 702 Binder         SUB-D-25         2x SUB-D-15 SUB-D-25           Driver electronics         external 19-inch rack mount            Weight [kg]         < 0.5	Operating temperature [°C]	non-condensing – 55			
Electrical connectionsBinderSUB-D-25SUB-D-25Driver electronicsexternal 19-inch rack mountWeight [kg]< 0.5	Body				
Weight [kg]       < 0.5       < 5       < 15       < 25         Laser head dimensions (L × W × H) [mm³]       125×52×52       140×250×123       280×270×123       415×375×148         Laser class product (EN-60825)       4       4       4	Electrical connections	SUB-D-25			
Laser head dimensions (L × W × H) [mm³]       125× 52× 52       140× 250× 123       280× 270× 123       415× 375× 148         Laser class product (EN-60825)       4	Driver electronics	external 19-inch rack mount			
Laser class product (EN-60825) 4	Weight [kg]	< 0.5	< 5	< 15	< 25
	Laser head dimensions (L $\times$ W $\times$ H) [mm <sup>3</sup> ]	125× 52× 52	140× 250× 123	280× 270× 123	415× 375× 148
Expected lifetime [h] 20000	Laser class product (EN-60825)	4			
	Expected lifetime [h]	20000			

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- 1. This is a preliminary specification sheet; validation of specification is in process.
- 2. If any other requirements are needed, please contact us.
- 3. Specifications at 20  $^{\rm o}{\rm C},$  at the beginning of the lifetime.
- 4. Specification are subjected to chips availability.
- 5. Other centre wavelengths on request. Everything between 1900 nm and 2400 nm will have very similar properties.
- 6. Measured at FWHM.
- 7. Values depend on power supply and driver electronics chosen.
- 8. Voltage from the power supply must be higher, as due to high current there will be a voltage drop in the cables.
- 9. Measured at FW95% energy.
- 10. Other fiber connectors available on request.
- 11. Determined by taking  $1\sigma$  values and under assumption of a NA = 0.22 fiber.
- 12. Values related to coolant properties are recommendations. External chiller is needed.

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UNE EN ISO 9001:2015

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