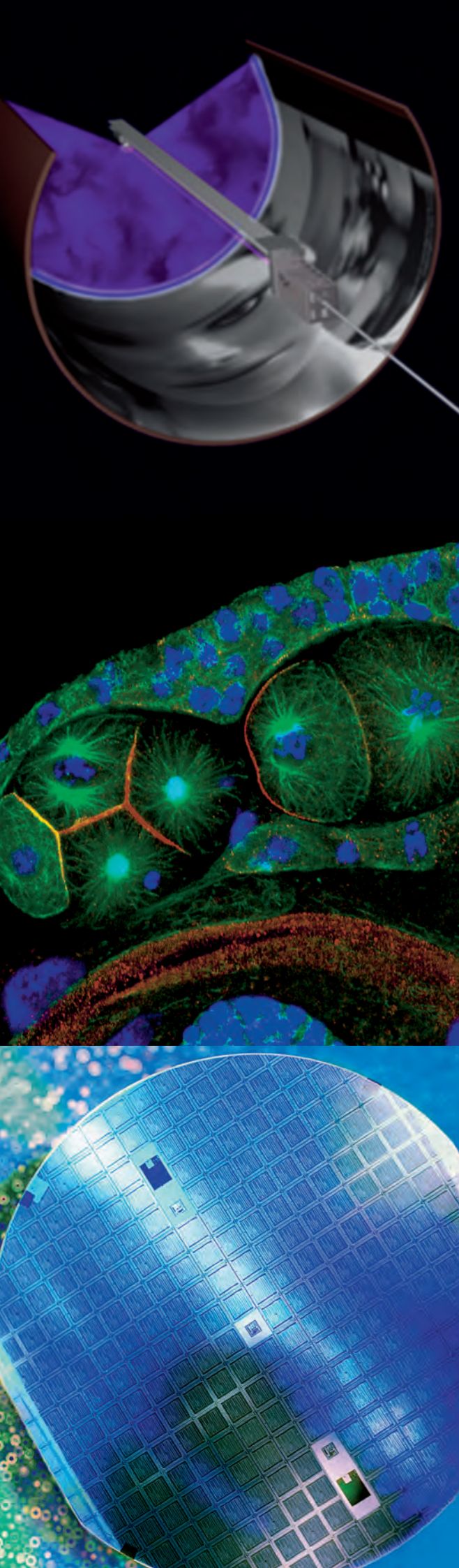


iBeam smart Family

Single-Mode Diode Lasers



Microscopy
Flow Cytometry
Metrology
Inspection
Microlithography
Computer-to-Plate Printing
Raman Microscopy / Spectroscopy
Interferometry



Contents

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iBeam smart PT	8
iBeam smart WS	10
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COLORFUL DIODE LASERS

Engineered for Maximum Performance

The iBeam smart family is the ultimate choice when looking for a high-performance, ultra-reliable OEM diode laser system. Providing wavelengths from the UV to the IR the iBeam smart family serves a variety of demanding applications. The success story of these lasers is based on excellence in all aspects of a modern diode laser: High optical output power, wide wavelength coverage, low noise operation and ultra-stable beam pointing.

The iBeam smart family offers unique features that set the benchmark in the competitive field of compact laser sources. High speed complete on/off modulation (with a true zero-photon off state) from a compact single box unit widely exceeds the performance of any acousto-optical modulation technique. Integration into optical setups is easy with the Feedback Induced Noise Eraser (FINE) function of the iBeam smart series. FINE makes the lasers insensitive to optical back reflec-

tions and guarantees a low noise operation even in the case of fiber coupling. Another highlight of the iBeam smart series is the SKILL speckle reduction feature ("Speckle KILLer"), which minimizes and stabilizes the coherence length of the laser at the push of a button.

TOPTICA's pigtailed diode laser line iBeam smart PT, is the market's gold standard for long-term power stability and reliability. This is achieved with TOPTICA's proprietary fiber coupling technology COOL^{DC} (Constant Optical Output Level – Dura-Calibrated). In addition TOPTICA's unique long-life fibers prevent fiber degradation at violet and UV wavelengths.

Using wavelength stabilized laser diodes within the iBeam smart WS, single-frequency operation is added to the series. With linewidths in the 10 MHz range and coherence lengths of several meters, the iBeam smart WS is a compact and cost-effective choice for demanding applica-

Applications

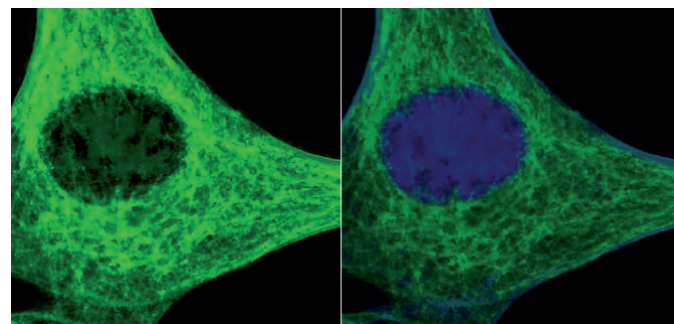
- Microscopy
- Flow Cytometry
- DNA Sequencing
- Microarray Scanners
- Metrology
- Inspection
- Microlithography
- Computer-to-Plate Printing
- Disc Mastering
- Raman Microscopy/Spectroscopy
- Diffuse Correlation Spectroscopy (DSC)
- Interferometry

tions, e.g. Raman, interferometry or diffuse correlation spectroscopy. Please do not hesitate to contact us for customized solutions! We will be happy to modify the parameters of our lasers according to your needs.



UNIQUE FEATURES

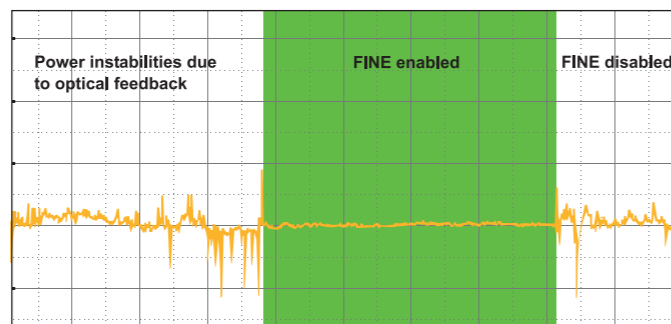
Powerful, High-Quality, Ultra Reliable



Complete on/off

The advanced electronics of the iBeam smart allow a “complete on/off” modulation up to 100 MHz. The hereby increased signal-to-noise ratio is advantageous to all measurement setups. But especially advanced microscopy techniques that require a true „zero photon“ dark state will benefit the most from this feature.

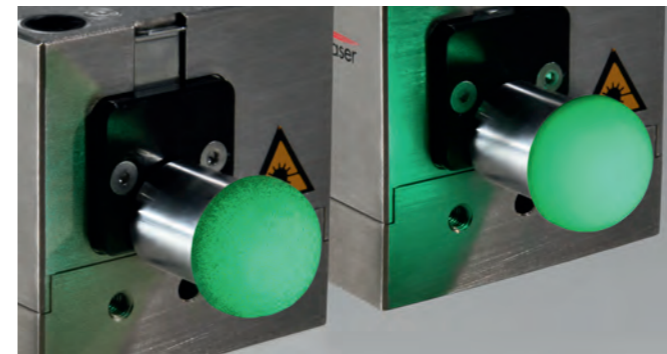
- Up to 100 MHz modulation with true “zero photon” off state
- Outstanding rise and fall times with “complete off”
- User configurable



FINE

The Feedback Induced Noise Eraser FINE eliminates power instabilities and high noise levels that can be caused by back reflections into the laser. By a simple push of a button ultra-stable operation is established and the need for costly optical isolators is often eliminated.

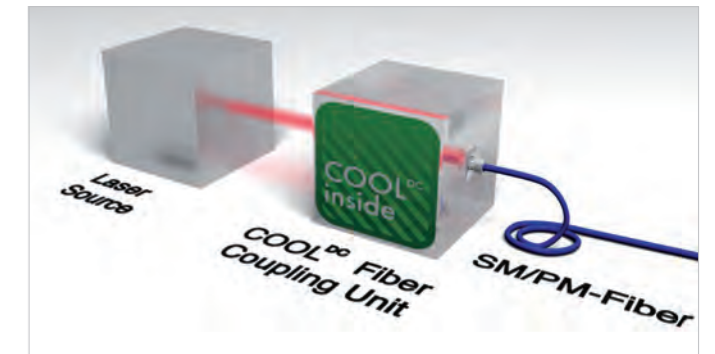
- Elimination of feedback induced power instabilities
- Intensity noise reduction
- Purely electronic feature – no additional hardware such as optical isolators necessary
- Push of a button functionality



SKILL

The SKILL function acts as a purely electronic „Speckle KILLer“. By decreasing the longitudinal coherence lengths of the emitted light, the speckle generating mutual interference of wavefronts is reduced. Thus annoying speckle noise on detectors and imaging systems can be lowered to a minimum.

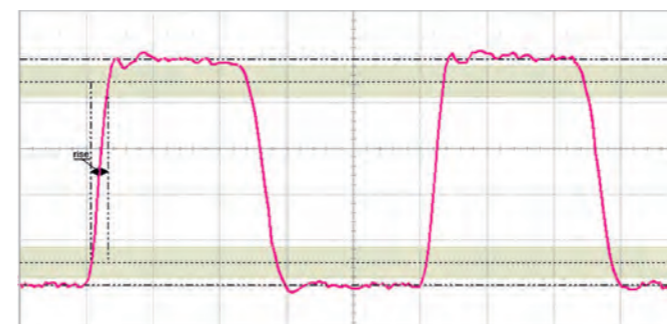
- Reduces speckle patterns
- Optimizes coherence length
- Purely electronic feature
- Integrated in all iBeam smart diode lasers
- Most effective at lower laser power



COOL^{DC}

TOPTICA's unique COOL technology guarantees a Constant Optical Output Level for the high power, single-mode fiber-coupled laser iBeam smart PT. The special mechanical design leads to outstanding robustness against thermal and mechanical influences. The need for time-consuming single-mode fiber alignment is eliminated, making the iBeam smart PT an „out of the box – ready to use“ laser.

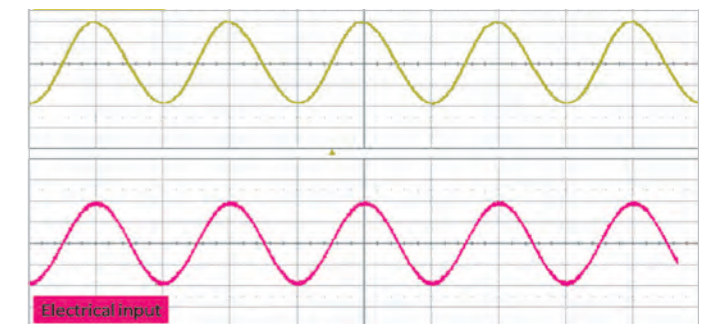
- Factory set to permanent fiber coupling efficiency of higher than 50 %
- Unsusceptible to thermal fluctuations
- Unsusceptible to extensive mechanical disturbances
- Drop shipment warranty



Digital Modulation

The digital modulation option adds a 250 MHz, true asynchronous TTL trigger input. The included „Autopulse“ feature enables the laser to operate on self-generated pulses up to 10 MHz.

- 250 MHz digital modulation speed
- Excellent rise and fall times (< 1.5 ns)
- Mixed-mode triggering (analog and digital modulation simultaneously)
- Multi-level triggering



Analog Modulation

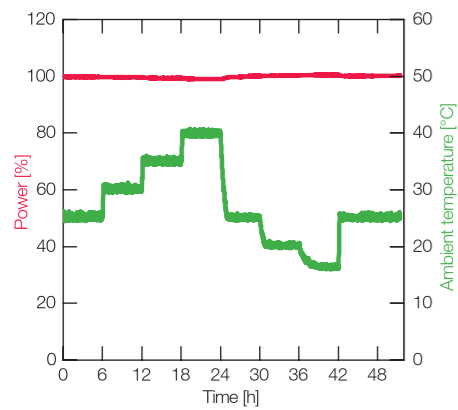
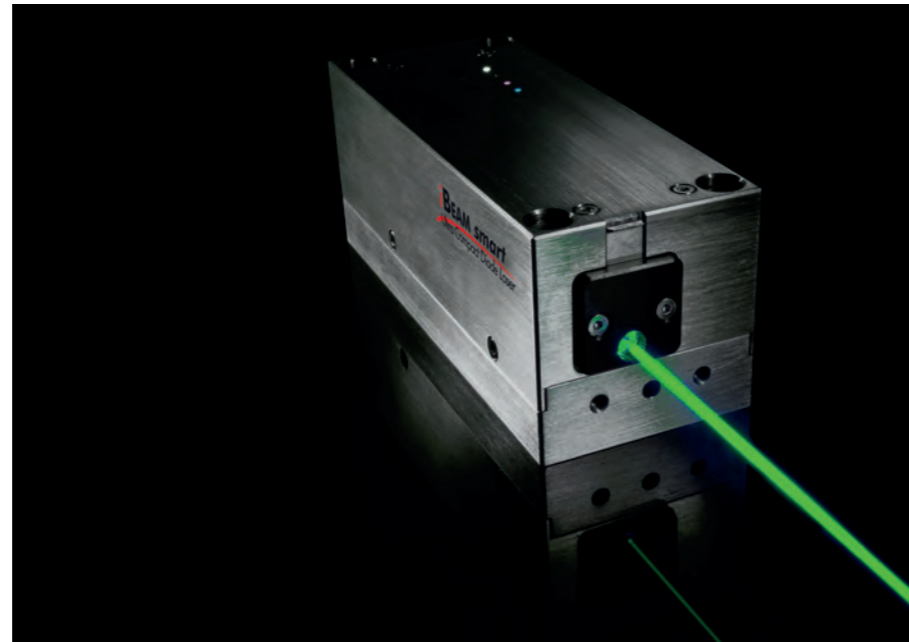
All iBeam smart models incorporate an analog modulation input, enabling modulation up to 1 MHz.

- No extra hardware (e.g. AOM/AOTF) required
- User configurable (high-/low-active)
- Mixed-mode triggering (analog and digital modulation simultaneously)

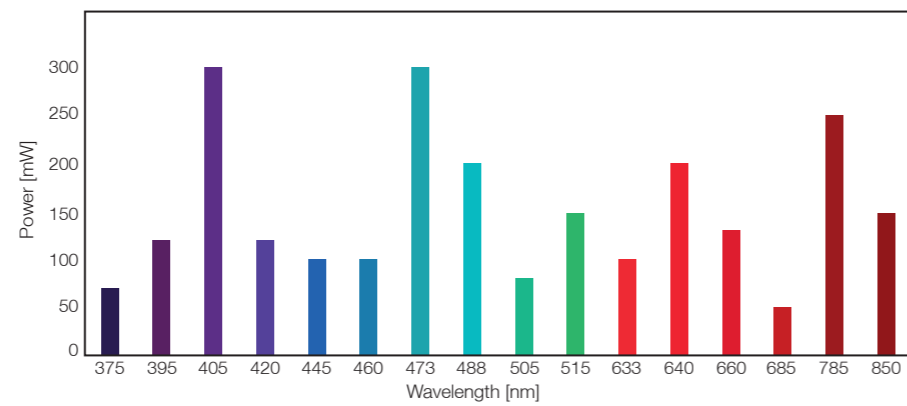


Key Features

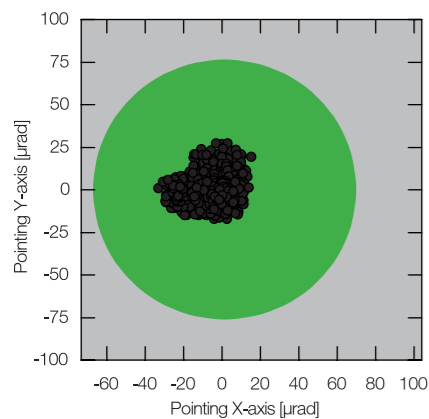
- Single-mode, TEM₀₀ laser from 375 to 1060 nm
- True one box solution, no control box necessary
- Complete off (zero photon) modulation
- Ultimate long-term power and beam pointing stability
- FINE and SKILL to eliminate noise and speckle
- Analog Modulation up to 1 MHz, Digital Modulation up to 250 Mhz
- Fiber coupling with up to 90 % SM/PM fiber coupling efficiency available



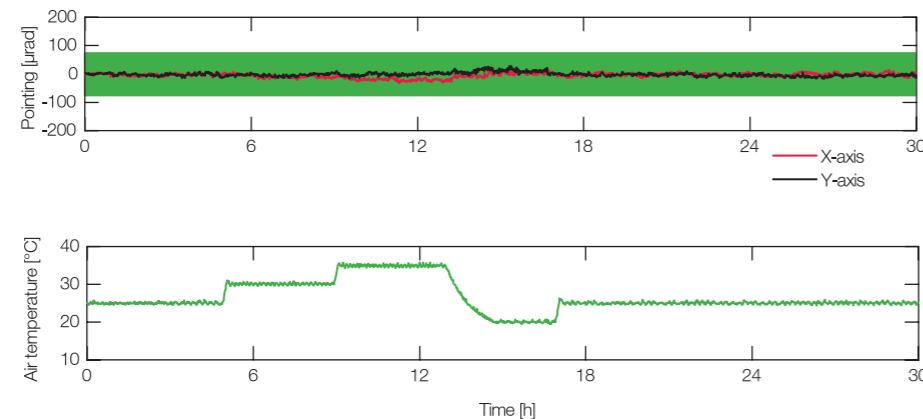
Best power stability (< 0.5 % drift over 48 h) even under changing ambient temperature



iBeam smart standard wavelengths with highest optical power.



Ultimate beam pointing stability – beam stays easily within specification.



Best power stability (< 0.5 % drift over 48 h) even under changing ambient temperature.

Specifications iBeam smart																
iBeam smart-S	375-S	395-S	405-S	420-S	445-S	460-S	473-S	488-S	505-S	515-S	633-S	640-S	660-S	685-S	785-S	850-S
Optical Specifications																
Wavelength ⁽¹⁾ (nm)	375	395	405	420	445	460	473	488	505	515	633	640	660	685	785	850
Wavelength range (nm)	± 5	± 5	± 4	± 5	± 5	+0/-10	± 5	± 4	± 2	± 5	± 3	± 5	± 3	± 5	± 5	± 5
Output power (mW)	70	120	100/150/300	120	100	100	100/300	100/200	80	100/150	100	150/200	130	50	125/250	150
Min. fiber coupled output power (mW)	45	75	100/200	75	65	65	65/200	65/130	50	65/100	65	100/130	90	30	80/160	100
Power stability	< 0.5 % (drift over 48 h @ room temperature ± 5 °C)															
RMS noise	< 0.2 % (10 Hz - 10 MHz)															
Beam diameter (typ. @1/e ²) (mm)	1.3	1.2	1.2	1.2	1.3	1.1	1.3	1.3	1.1	1.3	1	1.1	1.2	1.2	1.4/0.8	1
Beam shape, ellipticity	circular, < 10%															
Typ. divergence (mrad)	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.7	< 0.7	< 0.8	< 0.7	< 1	< 1	< 1	< 1	< 1/1.6	< 1.4
M ²	< 1.2															
Spectral Mode	TEM ₀₀															
Pointing stability	< 5 µrad/K															
Static alignment ⁽²⁾	± 0.2 mm (xy), ± 0.5 mrad (angular)															
Polarization	Linear, Orientation: vertical (± 3°), Ratio > 100:1 (typ.)															
Electronic Specifications																
Analog Modulation																
Max. modulation frequency	1 MHz															
Analog modulation extinction ratio	10 ⁶															
Digital Modulation (option)																
Supported signal levels	TTL															
Max. modulation frequency	250 MHz (100 MHz with complete off)															
Rise/fall time	< 1.5 ns (10 % - 90 %)															
Modulation extinction ratio	> 1000 : 1 (∞ with complete off) ⁽³⁾															
Electronic Shutter																
Rise/fall time	40 / 10 µs															
Extinction ratio	∞ (complete off) ⁽²⁾															
General and Environmental Specifications																
Qualification	CE marked, Class IIIb qualification, Level 4 ESD protection															
PC interface	RS 232, ≤ 115.200 baud															
DC input	12 V DC, 2A															
Power consumption	< 18 W (typ. < 6 W)															
Heat dissipation	< 12 W (baseplate @ 50 °C)															
Warm-up time	< 5 min															
Temperature range	15 - 40 °C (operation), -10 - 60 °C (storage)															
Relative humidity	< 90 % (non-condensing)															
Dimensions	40 x 40 x 100 mm ³ (H x W x D)															
Weight laser head	< 250 g															

⁽¹⁾Other wavelengths on request. ⁽²⁾Static alignment tolerances are relative to reference holes in baseplate. ⁽³⁾Except for 488, 505 and 515 nm. Please inquire.

All specifications are subject to change without notice.

iBeam smart PT

Pigtailed High-Performance Diode Laser

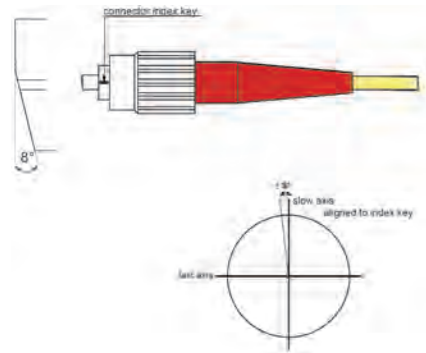


Class 3B Laser Product EN 60825-1:2014.
Visible and invisible laser radiation. Avoid direct exposure to beam.
Caution - Class 3B visible and invisible laser radiation when open.
Avoid exposure to the beam

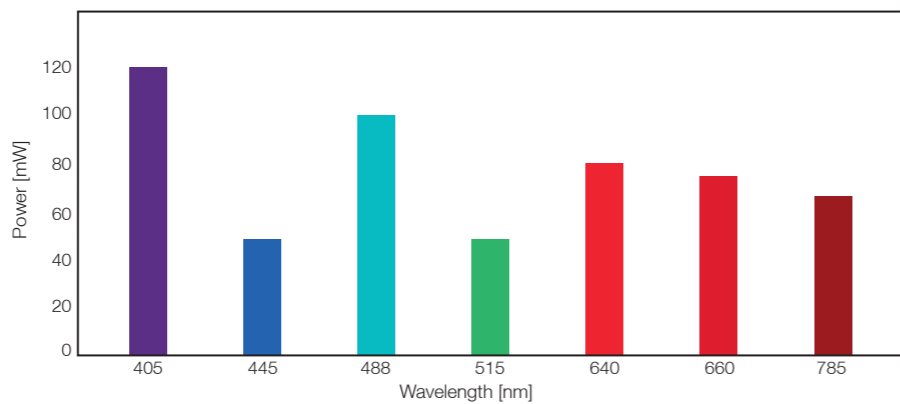
Specifications

Key Features

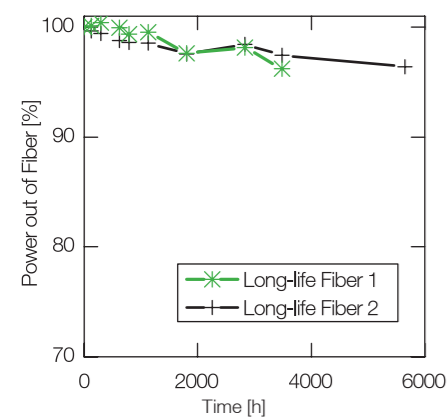
- Pigtailed diode laser from 405 to 785 nm
- COOL^{DC}: ultra stable permanent fiber coupling
- FINE: Eliminates noise from optical feedback
- Complete off (zero photon) modulation
- SKILL: Reduces speckle in your application
- Analog Modulation up to 1 MHz, Digital Modulation up to 250 Mhz
- FC/APC fiber connector (others on request)



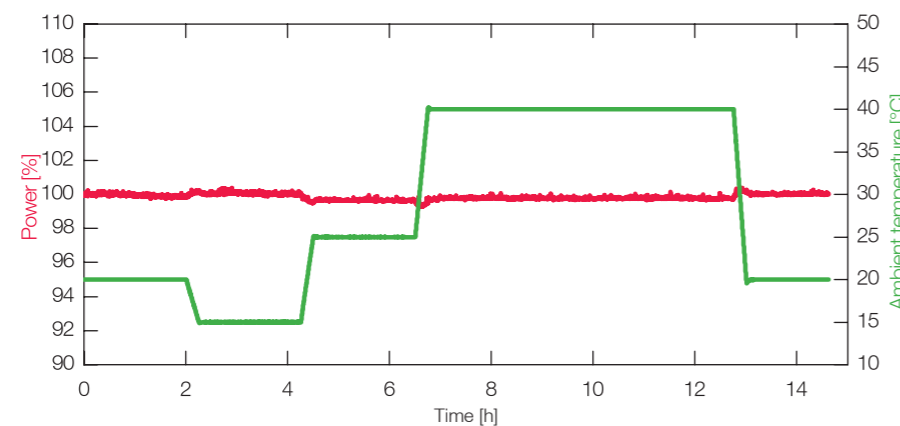
Standard fiber output connector FC/APC and polarization orientation at fiber connector



iBeam smart PT standard wavelengths with highest optical power



TOPTICA long-life fiber. Minimum degradation at UV/violet wavelengths



Fiber coupled power stability (< 0.5 % drift over 24 h) even under changing ambient temperature

Specifications iBeam smart PT							
iBeam smart PT	405	445	488	515	640	660	785
Optical Specifications							
Wavelength ⁽¹⁾ (nm)	405	445	488	515	640	660	785
Wavelength range (nm)	± 4	± 5	± 4	± 5	± 5	± 3	± 5
Fiber coupled output power (mW)	60 / 120	50	50 / 100	50	80	75	70
Power stability	± 2 % (drift over 24 h @ room temperature ± 5 °C)						
RMS noise	≤ 0.2 % (10 Hz - 10 MHz)						
Beam shape, ellipticity	circular, < 10%						
M ²	< 1.1						
Polarization ration (typ.)	> 100 : 1, linear						
Polarization orientation tolerance	± 3°						
Fiber Specifications							
Fiber output connector	FC/APC (8° angled) standard, others like FC/PC, FC/APC or SC on request						
Fiber cable length (typ.)	2 m						
Fiber cable type	3 mm Kevlar reinforced PVC						
Fiber minimum bend radius	40 mm						
Fiber type	single-mode, polarization maintaining						
Fiber numerical aperture (5 %) (typ.)	0.06	0.06	0.06	0.09	0.11	0.11	0.12
Mode field diameter	3.0 μm	3.0 μm	3.5 μm	4.2 μm	4.2 μm	4.2 μm	4.5 μm
Electronic Specifications							
Analog Modulation							
Maximum analog modulation frequency	1 MHz						
Analog modulation extinction ratio	10 ⁶						
Digital Modulation (option)							
Supported digital signal levels	TTL / TTL complete off						
Maximum digital modulation frequency	250 / 100 MHz						
Rise/fall time	< 1.5 ns (10 % - 90 %)						
Digital modulation extinction ratio	> 1000 : 1 / ∞ (with complete off) ⁽²⁾						
Electronic Shutter							
Rise/fall time	40 / 10 μs						
Extinction ratio	∞ (complete off) ⁽²⁾						
General and Environmental Specifications							
Qualification	CE marked, Class IIIb qualification, Level 4 ESD protection, RoHS compliant						
PC interface	RS 232, ≤ 115.200 baud						
DC input requirements	12 V DC, < 2 A						
Power consumption	< 18 W (typ. < 6 W)						
Heat dissipation	< 12 W (baseplate @ 50 °C)						
Warm-up time	< 5 min						
Operating temperature range	15 .. 40 °C						
Storage temperature range	-10 .. 60 °C						
Operating relative humidity	< 90 % (non-condensing)						
Dimensions laser head	40 x 40 x 145 mm ³ (H x W x D)						
Dimensions laser head with fiber minimum bend radius	40 x 40 x 195 mm ³ (H x W x D)						
Weight laser head	< 360 g						

⁽¹⁾Other wavelengths on request. ⁽²⁾Except for 488 and 515 nm. Please inquire.

iBeam smart WS

Wavelength-Stabilized Diode Laser

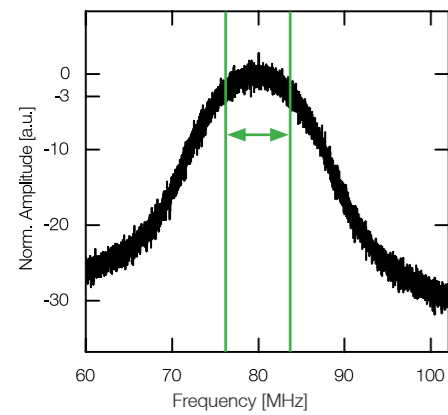
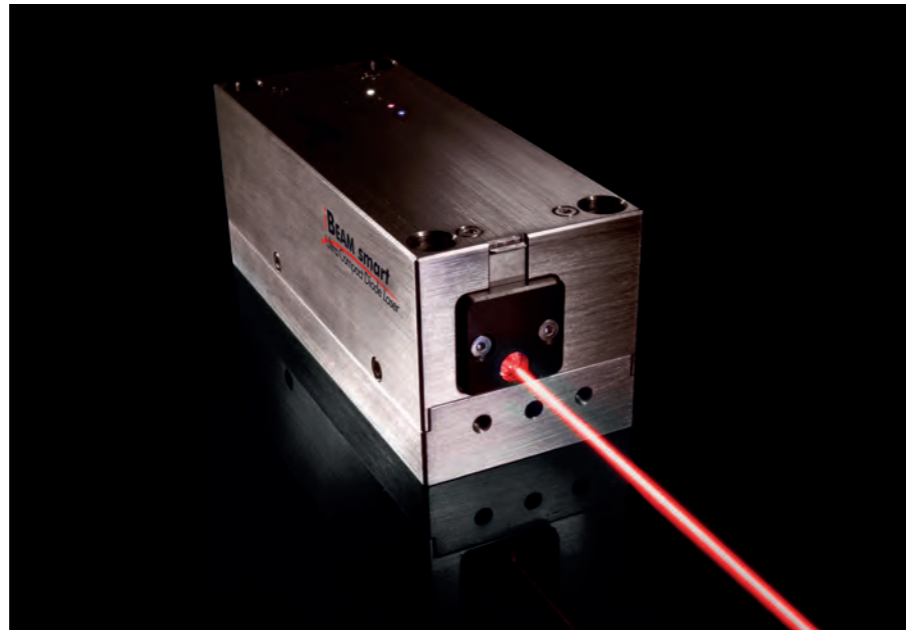


Class 3B Laser Product EN 60825-1:2014.
Visible and invisible laser radiation. Avoid direct exposure to beam.
Caution - Class 3B visible and invisible laser radiation when open.
Avoid exposure to the beam

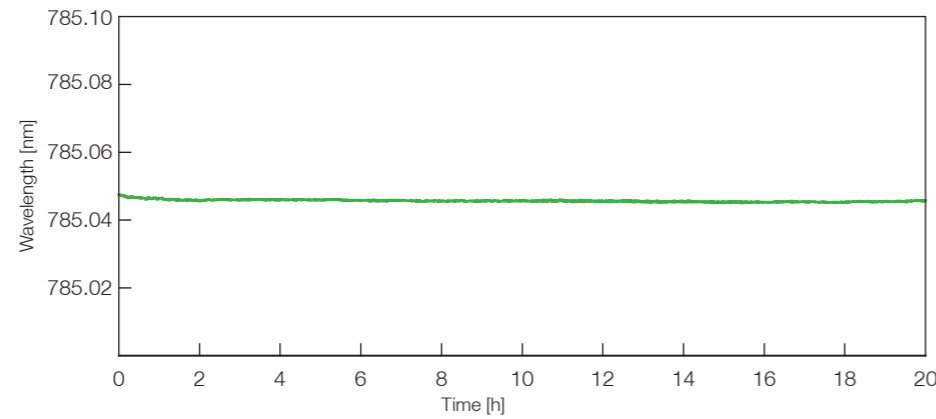
Specifications

Key Features

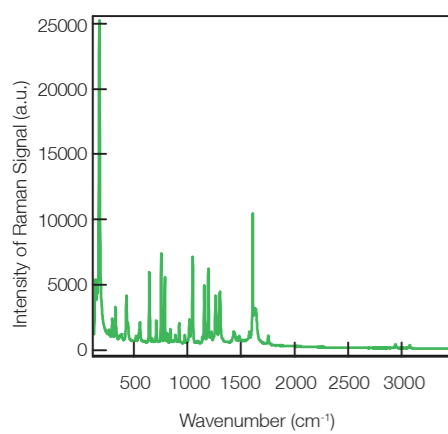
- Standard wavelengths: 633 nm, 638 nm, 685 nm and 785 nm
- High power diode laser (up to 120 mW)
- Narrow linewidth (typ. 10 MHz)
- Fully computer controlled
- Perfect choice for Raman applications
- Ultra compact design
100 x 40 x 40 mm³



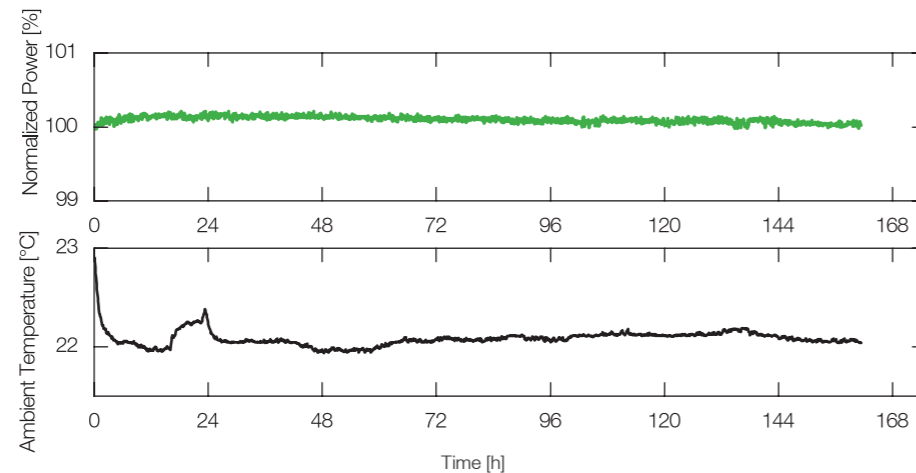
Typical linewidth < 10 MHz



Ultimate wavelength stability, no mode-hopping



iBeam smart WS – best suited for Raman applications



Excellent power stability

Specifications iBeam smart WS				
iBeam smart WS	633-S-WS	638-S-WS	685-S-WS	785-S-WS
Optical Specifications				
Wavelength (nm)	633	638	685	785
Center wavelength range (nm)	± 1	± 1	± 1	± 1
Wavelength stability	< 15 pm	< 15 pm	< 15 pm	< 15 pm
Spectral linewidth	< 25 MHz	< 25 MHz	< 25 MHz	< 15 MHz
ASE suppression (typ.)	25 dB			
Max. output power	40/70 mW	30 mW (120 mW ⁽⁶⁾)	45 mW	120 mW
Power stability	< 0.5 % (drift over 48 h @ constant ambient)			
Beam diameter (typ. @ 1/e ²)	0.6 x 0.9 mm ⁽¹⁾	1.4 mm	1.6 mm	1.2 mm
Beam shape	elliptical ⁽²⁾		circular	
Ellipticity	30 % ⁽³⁾		< 10 %	
Divergence (typ.)	< 2 mrad		< 1 mrad	
M ²	< 1.5		< 1.5 (typ. 1.2)	
Pointing stability	< 10 μrad/K		< 10 μrad/K	
Static alignment ⁽⁴⁾	± 0.4 mm (xy), ± 1 mrad (angular) ⁽⁵⁾		± 0.2 mm (xy), ± 0.5 mrad (angular)	
Polarization ration (typ.)			> 50 : 1, linear	
Polarization orientation tolerance			± 3°	
General and Environmental Specifications				
Qualification	CE marked, Class IIIb qualification, Level 4 ESD protection, RoHS compliant			
DC input requirements	12 V DC, < 2 A			
Power consumption	< 18 W (typ. < 6 W)			
PC interface	RS 232, ≤ 115.200 baud			
Operating temperature range	15 .. 40 °C			
Storage temperature range	-10 .. 60 °C			
Operating relative humidity	< 90 % (non-condensing)			
Dimensions laser head	40 x 40 x 100 mm ³ (H x W x D)			













⁽¹⁾ At 50 cm behind laser aperture
⁽²⁾ Circularisation requires additional external beam shaping
⁽³⁾ Far field, > 150 cm
⁽⁴⁾ Static alignment tolerances are relative to reference holes in base plate
⁽⁵⁾ Central beam aperture different from drawing on p.14
⁽⁶⁾ Please enquire for optical specifications

All specifications are subject to change without notice.

Additional wavelengths like 405, 640, 658, 690, 780, 808, 850 nm and more available on request.

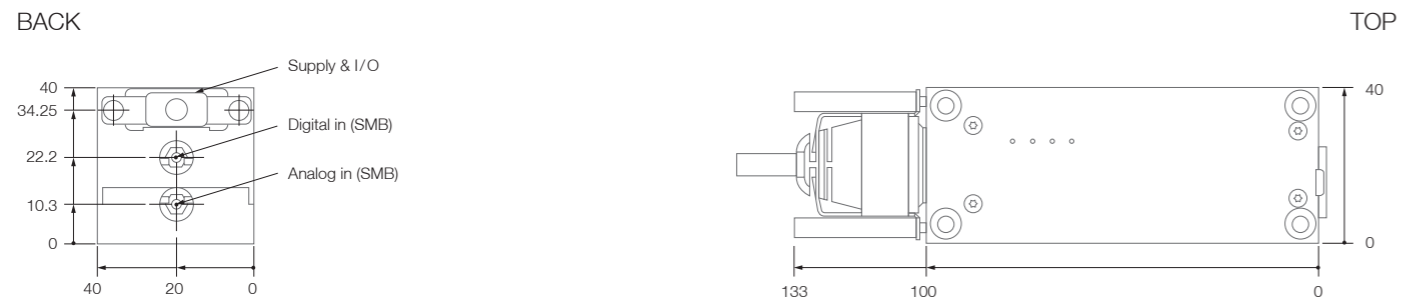
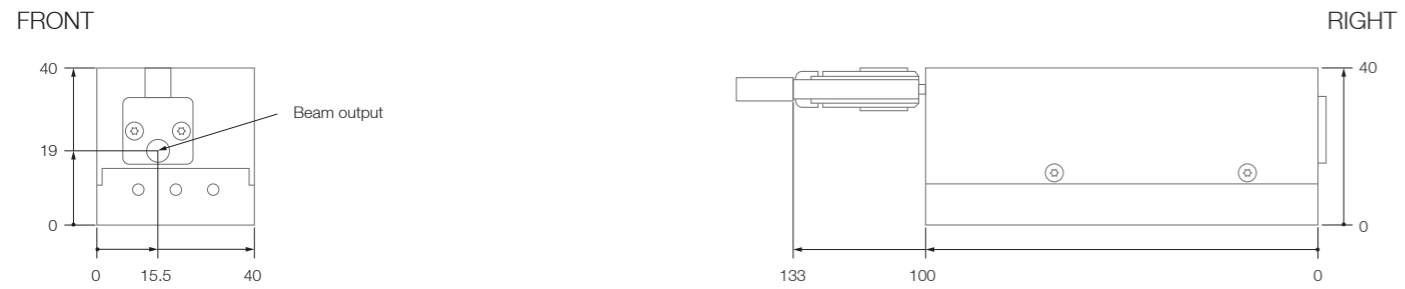
Option	Description	iBeam smart	iBeam smart PT	iBeam smart WS
	iBeam smart Pulse Option The pulse option enables the user to apply asynchronous, digital modulation signals to the iBeam smart. With optical rise and fall times in the 1 ns range, bandwidths up to 250 MHz can be achieved. The pulse option also provides the „Autopulse“ feature. Frequencies up to 10 MHz can be programmed to the iBeam smart, making an external signal generator dispensable.	✓	✓	✓*
	Wavelength Selection Demanding applications often need very specific wavelengths, e.g. to perfectly match absorption lines or for consistent results due to high system-to-system repeatability. For such cases TOPTICA offers wavelength selection better than ±1 nm inside the available standard wavelength range.	✓	✓	✓
	SmartDock Highly efficient (> 60 % guaranteed, typical > 75 %) fiber-coupling is possible with this add-on fiber-coupler for the iBeam smart. TOPTICA's patented design allows straight forward alignment, combined with ultra-stable long-term performance.	✓		✓
	Clean-Up Filter Laser clean-up filters provide high transmission (> 90 %) of designated wavelengths and eliminate unwanted spontaneous emission when spectral purity is critical.	✓	✓	
	External Control Box The CDRH compliant external controller helps scientific customers to easily integrate the laser into their setup. It provides the user with a key switch and access to all important control lines.	✓	✓	✓
	FiberOut This fiber output collimator with adjustable collimation guarantees excellent beam quality after the fiber. The customer can select from different lenses in order to achieve the beam diameter best suited for his application.	✓	✓	✓
	Optical Isolator The iBeam smart can be equipped with an external optical isolator. This option is recommended for the iBeam smart WS in order to guarantee stable single-frequency operation.	✓		✓

* Some laser characteristics might be influenced (e.g. wavelength stability).

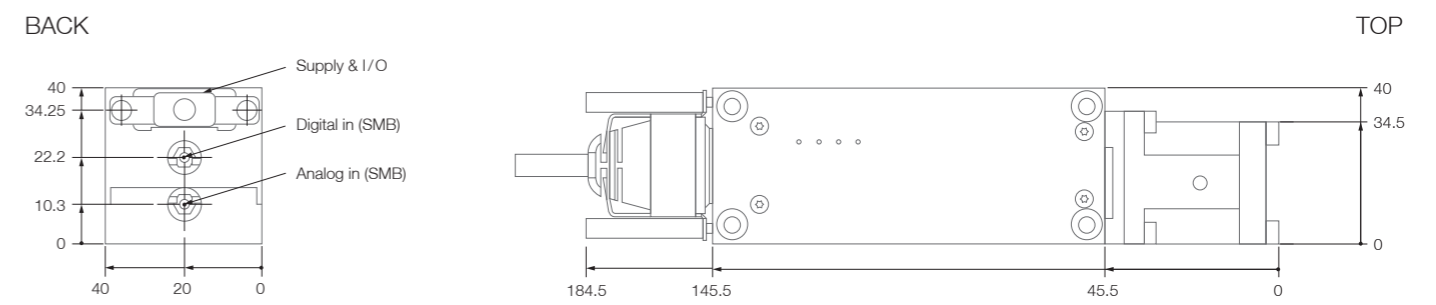
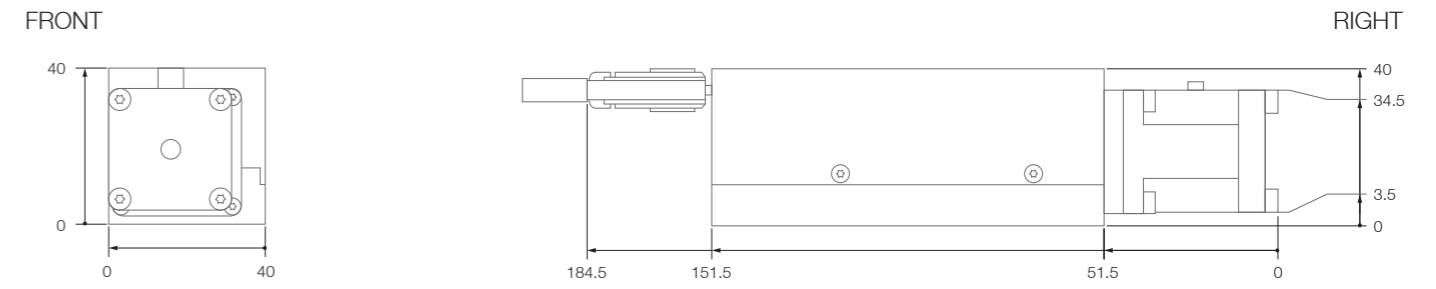
Application	TEM ₀₀	Power Stability	Pointing Stability	Complete Off	Fast Digital Modulation	Noise < 0.2 %	Wavelength Selection	SM/PM Fiber	FINE/SKILL	Narrow Linewidth	Common Wavelength(s)	iBeam smart	iBeam smart PT	iBeam smart WS
 Microscopy	✓	✓	✓	✓				✓	✓		375 nm .. 640 nm	✓	✓	
 Flow Cytometry	✓	✓	✓		✓	✓			✓		375 nm .. 640 nm	✓	✓	
 DNA Sequencing	✓	✓	✓		✓	✓					375 nm .. 660 nm	✓	✓	
 HTS/HCS	✓	✓	✓			✓			✓		375 nm .. 640 nm	✓	✓	
 Raman Microscopy/Spectroscopy	✓	✓	✓				✓	✓		✓	785 nm			✓
 Diffuse Correlation Spectroscopy	✓	✓	✓							✓	785, 850 nm			✓
 Semicon Inspection	✓	✓	✓		✓	✓	✓	✓	✓		405 nm .. 785 nm	✓	✓	
 Metrology/Ellipsometry	✓	✓	✓			✓	✓	✓	✓		375 nm .. 785 nm	✓	✓	
 Interferometry	✓	✓	✓			✓	✓			✓	633 nm			✓
 Microlithography	✓	✓	✓		✓						375, 405, 445 nm	✓	✓	
 Computer-to-Plate (CTP) Printing	✓	✓	✓	✓	✓	✓					405 nm	✓	✓	
 Optical Data Storage	✓	✓	✓	✓	✓	✓			✓		405 nm	✓	✓	

Technical Drawings

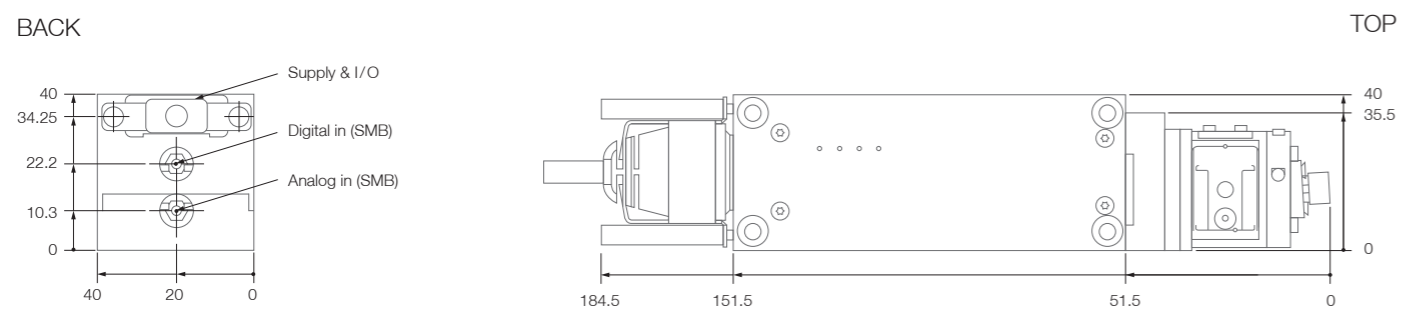
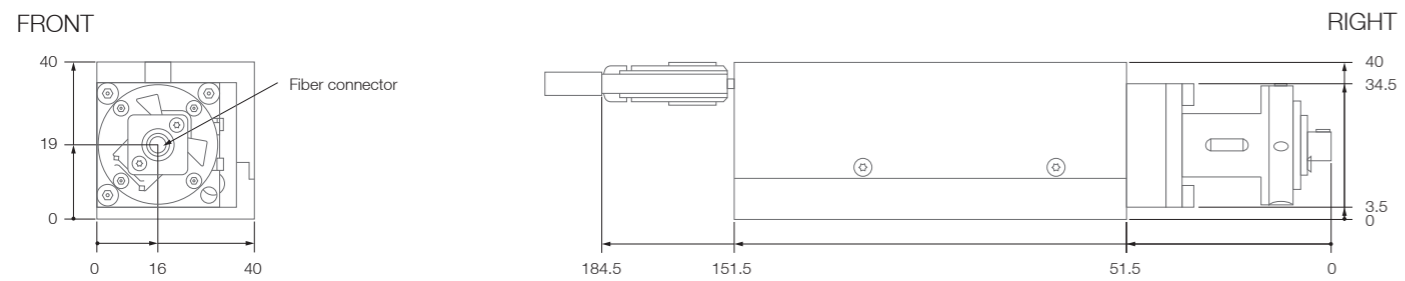
iBeam smart / iBeam smart WS



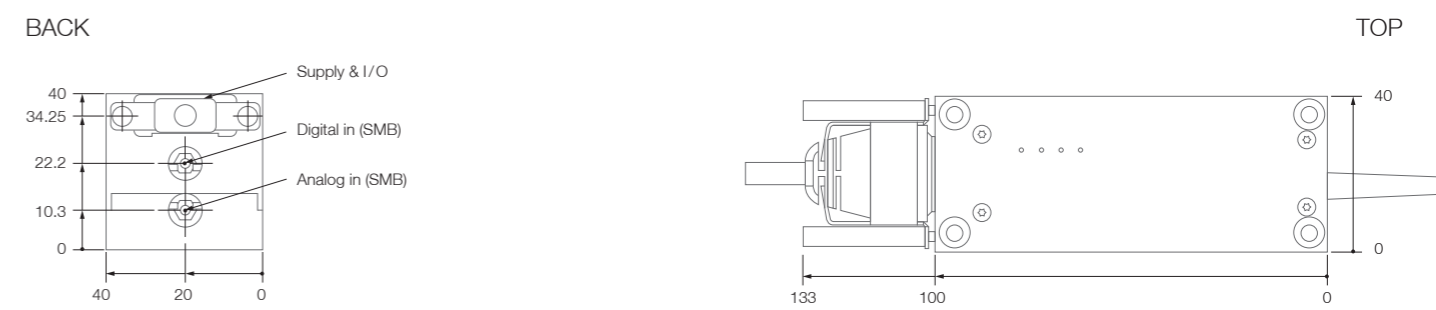
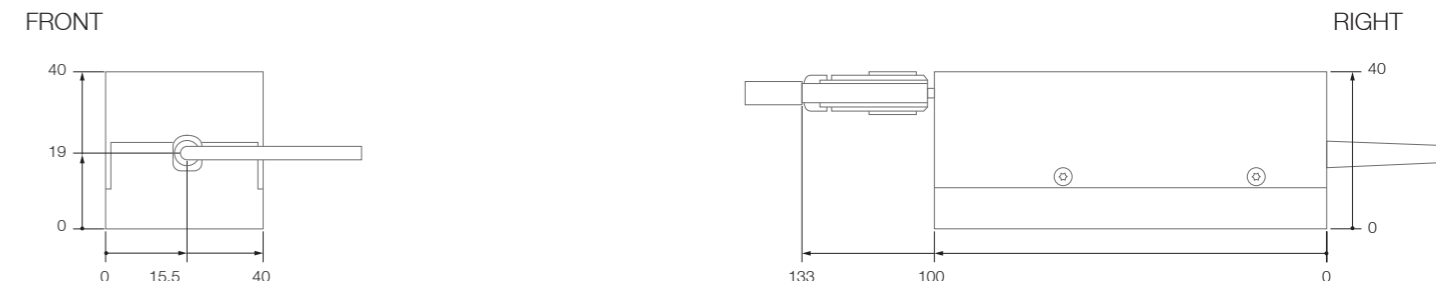
iBeam smart with isolator



iBeam smart with SmartDock



iBeam smart PT



All dimensions given in mm.
Detailed technical drawings are available on our website.



TOPTICA Worldwide

Australia & New Zealand

Lastek Pty. Ltd.

Thebarton Campus
10 Reid Street
5031 Thebarton, SA, Australia
Phone: +61 8 8443 8668
Fax: +61 8 8443 8427
sales@lastek.com.au
www.lastek.com.au

China

Universal Technology Co. Ltd.

A1505 NanXinCang Business Tower
No. 22 DongSiShiTiao
DongCheng District
Beijing, 100037, P.R. China
Phone: +86 10 516 903 88-601
Fax: +86 10 516 901 00
oe@universaltchco.cn
www.unjiabo.com

France

Opton Laser International

Parc Club d'Orsay Université
29, rue Jean Rostand
F-91893 Orsay Cedex, France
Phone: +33 1 6941 0405
Fax: +33 1 6941 3290
ventes@optonlaser.com
www.optonlaser.com

India

Simco Global Technology & Systems Ltd.

Simco House (Head Office)
14 Bhawani Kunj
Behind Sector D-II Vasant Kunj
110070 New Delhi, India
Phone: +91 99 1020 7575
Fax: +91 11 2612 4461
simco.del@simcogroup.in
www.simco-groups.com

Israel

Lahat Technologies Ltd.

17 Atir Yeda St.
Kfar Saba 446413, Israel
Phone: +972 9 76 46 200
Fax: +972 9 76 46 204
sales@lahat.co.il
www.lahat.co.il

Japan

TOPTICA PHOTONICS, K.K.

2-9-5, Miyanishi-cho, Fuchu-shi,
Tokyo, 183-0022,
Japan
Phone: +81 42 306 9906
Fax: +81 42 306 9907
sales@toptica.com
www.toptica.com

Korea

JINSUNG LASER

7F, E-Dong, Leaders Town
#310, ManNyeon-Dong, Seo-Gu
Daejeon, 302-834, South Korea
Phone: +82 42 823 5300
Fax: +82 42 823 7447
sales@jinsunglaser.com
www.jinsunglaser.com

Russia

EuroLase Ltd.

Profsoyuznaya 93-A
Office 404
117997 Moscow, Russia
Phone: +7 495 3363044
Fax: +7 495 3363044
eurolase@eurolase.ru
www.eurolase.ru

Singapore, Malaysia & Thailand

Precision Technologies Pte Ltd

211 Henderson Road # 13-02
Henderson Industrial Park
Singapore 159552
Phone: +65 6273 4573
Fax: +65 6273 8898
precision@pretech.com.sg
www.pretech.com.sg

Spain

Delta Optics

Edificio CTM O-227
Orta Villaverde-Vallecas, Km 3,500
28053 Madrid, Spain
Phone: +34 911 130 824
Fax: +34 910 113 757
info@deltaoptics.es
www.deltaoptics.es

Taiwan

Luxton Inc.

F4, No. 2, Technology Road V
Hsinchu Science Park
Hsinchu 30078, Taiwan
Phone: +886 3 666 2097
Fax: +886 3 666 2124
service@luxton.com.tw
www.luxton.com.tw

United Kingdom & Ireland

TOPTICA Photonics UK

Unit SU4B, Lansbury Estate
102 Lower Guildford Road
Knaphill, Woking
Surrey, GU21 2EP, Great Britain
Phone: +44 1483 662 660
Fax: +44 1483 799 076
enquiries@toptica-uk.com
www.toptica.com

USA, Canada & Mexico

TOPTICA Photonics, Inc.

5847 County Road 41
Farmington, NY 14425, U.S.A.
Phone: +1 585 657 6663
Fax: +1 877 277 9897
sales@toptica-usa.com
www.toptica.com

Every other country not listed

TOPTICA Photonics AG

Lochhamer Schlag 19
D-82166 Graefelfing / Munich, Germany
Phone: +49 89 85837 0
Fax: +49 89 85837 200
sales@toptica.com
www.toptica.com



TOPTICA Photonics AG
Lochhamer Schlag 19
D-82166 Graefelfing / Munich
Germany
Phone: +49 89 85837-0
Fax: +49 89 85837-200
sales@toptica.com
www.toptica.com

TOPTICA Photonics, Inc.
5847 County Road 41
Farmington, NY 14425
U.S.A.
Phone: +1 585 657 6663
Fax: +1 877 277 9897
sales@toptica-usa.com
www.toptica.com

TOPTICA Photonics, K.K.
2-9-5, Miyanishi-cho, Fuchu-shi, Tokyo,
183-0022,
Japan
Phone: +81 42 306 9906
Fax: +81 42 306 9907
sales@toptica.com
www.toptica.co.jp