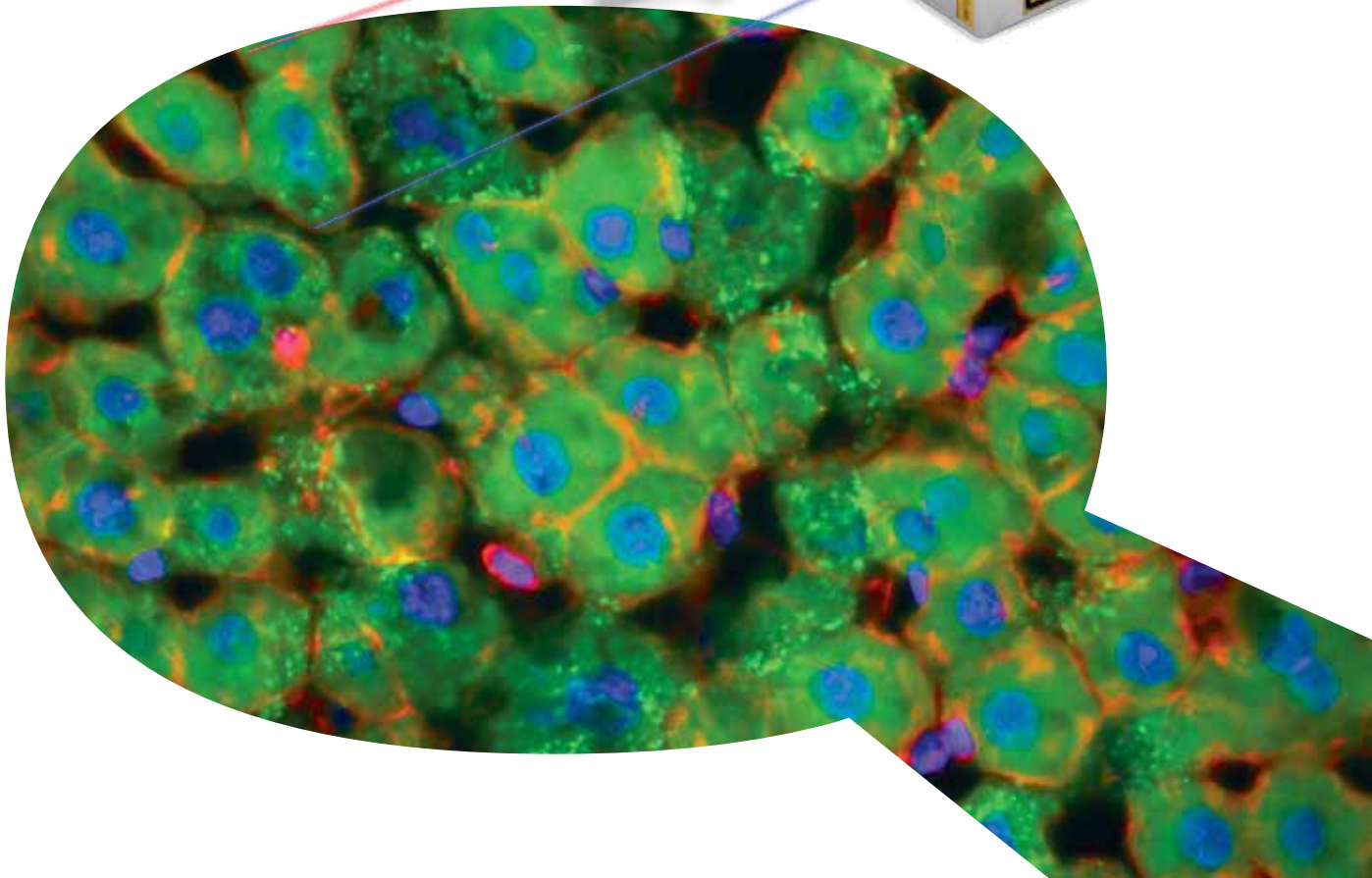


iFLEX[®] Lasers



Company Profile

Qioptiq, an Excelitas Technologies Company, designs and manufactures photonic products and solutions that serve a wide range of markets and applications in the areas of medical and life sciences, industrial manufacturing, defense and aerospace, and research and development.

Qioptiq benefits from having integrated the knowledge and experience of Avimo, Gsänger, LINOS, Optem, Pilkington, Point Source, Rodenstock, Spindler & Hoyer and others. In October 2013,

Qioptiq was acquired by Excelitas Technologies Corp., a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of OEM customers. The combined companies have approximately 5,500 employees in North America, Europe and Asia, serving customers across the world.

Visit www.qioptiq.com and www.excelitas.com for more information.

1877



Rodenstock
founded

1898



Spindler & Hoyer
founded

1966

Pilkington PE
Ltd. founded,
which later
becomes
THALES Optics

1969



Gsänger
Optoelektronik
founded

1984



Optem
International
founded

1991



Point Source
founded

1996



LINOS founded
through the merger
of Spindler & Hoyer,
Steeg & Reuter
Präzisionsoptik,
Franke Optik and
Gsänger Optoelektronik



Medical & Life Sciences



Industrial Manufacturing



Defense & Aerospace



Research & Development

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Total Wavelengths Served	15

2000



Rodenstock Präzisionsoptik acquired by LINOS

2001



AVIMO Group acquired by THALES

2005

Qioptiq founded as THALES sells High Tech Optics Group

2006 / 2007



Qioptiq acquires LINOS and Point Source as "members of the Qioptiq group"

2010



The new Qioptiq consolidates all group members under one brand

2013



Qioptiq is acquired by Excelitas Technologies

Precision Performance with iFLEX® Lasers

Qioptiq designs and manufactures high-performance solid-state laser systems and fiber optics for a range of scientific and industrial applications.

The iFLEX® family of laser technology includes the high performance iFLEX-iRIS™ laser series and the ultra-stable, multi-wavelength laser engine series of iFLEX-Gemini™ and iFLEX-Viper™.

4 Combine iFLEX lasers with the kineFLEX® single-mode fiber optics manufactured by Qioptiq, to create the world's most stable fiber coupled lasers.

With over 25 years of experience delivering market-leading technology Qioptiq continues to support customers with demanding applications in semicon, biotech, analytical and industry, through new innovations in iFLEX laser technology.



Applications & Features

Features:

- Exceptional power stability
- Unmatched beam pointing stability
- Ultra-low noise performance
- Excellent beam quality
- Fully integrated electronics
- Compact size for easy integration
- End user and OEM systems
- Integrated beam shaping
- "Plug & Play" fiber delivery
- "Set & Forget" alignment

Applications:

- Microscopy
- Flow Cytometry
- DNA Sequencing
- Metrology
- Inspection
- Ophthalmology
- Molecular Imaging
- Dynamic Light Scattering
- Spectroscopy
- Environmental Monitoring

“Integrate highly reliable laser sources into your OEM systems for the ultimate in precision and illumination performance”

iFLEX-iRIS

Compact, Single-Wavelength Laser Series

The iFLEX-iRIS™ laser series is a range of solid-state, high-performance lasers with low amplitude noise. For ease of use and integration, all wavelengths are offered in the same compact package with the same control inputs. All TEC and smart control electronics are integrated in the laser. They make ideal building blocks for OEM instrument designers and researchers alike.

Closed Loop Modulation (CLM)

The innovative Closed Loop Modulation (CLM) feature allows the lasers to operate with automatic power control feedback in all modes of operation; CW, plus digital, analogue and dual mode modulation. These lasers maintain excellent power stability in all modes of operation and throughout the laser lifetime. Unlike traditional open loop laser modulation, there is no need for laser calibration reset when using iFLEX-iRIS lasers with CLM feature.

Lasers with CLM are ultra-low noise in terms of RMS, RIN and periodic noise. They also offer precision adjustment at all output power levels. This is very useful for imaging



applications where a stable, ultra-low noise source will improve the signal-to-noise ratio and image resolution.

Fiber Delivery

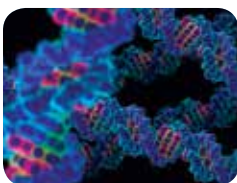
The iFLEX-iRIS lasers can be supplied with a single-mode fiber output. Alternatively, and as requirements change, the single-mode fiber can be added easily by the user. Thus, the iFLEX-iRIS provides true “Plug and Play” versatility as a free-space or fiber-coupled laser.

iFLEX-iRIS lasers are designed to fiber couple into the kineFLEX fiber delivery system. As a result these lasers are ultra-stable when used as free space or fiber coupled. There are standard options for different fiber lengths and either collimated or connector outputs.

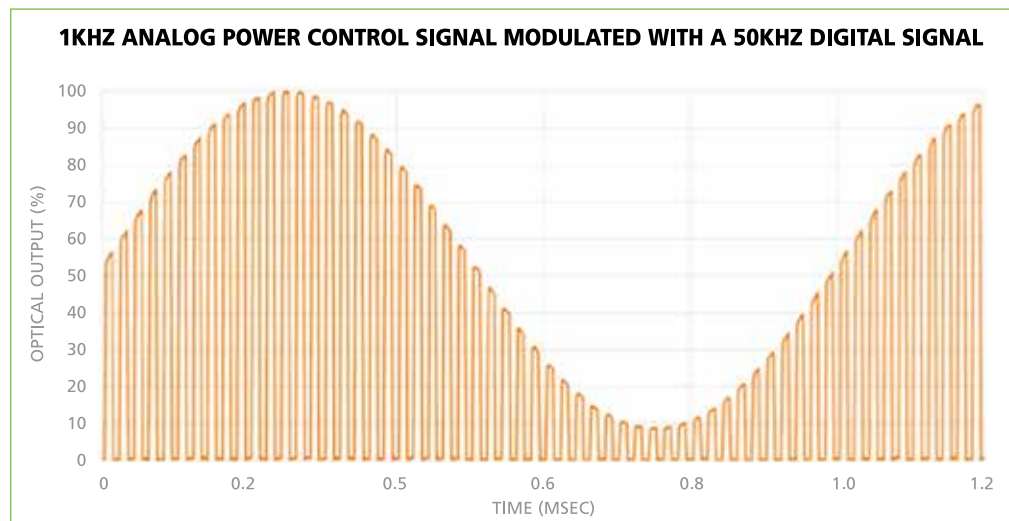
CDRH Compliance for End Users

iFLEX-iRIS lasers are CDRH compliant when used with an iFLEX-iRIS CDRH interlock power supply.

6



Example: Dual mode modulation

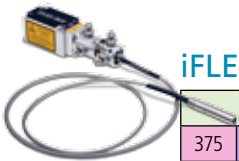


iFLEX-iRIS laser specification overview

iFLEX-iRIS lasers



Wavelengths (nm) and Power (mW)																						
375	405	413	445	458	473	488	505	515	520	532	561	594	633	637	642	647	660	670	730	780	830	852
20	50	100	20	20	75	20	50	20	30	20	20	20	30	20	20	50	80	10	20	70	100	35
40	100		50	70		40		50		40	40		70	100	40							
50	200		75			100		60							100							
488	220					140																

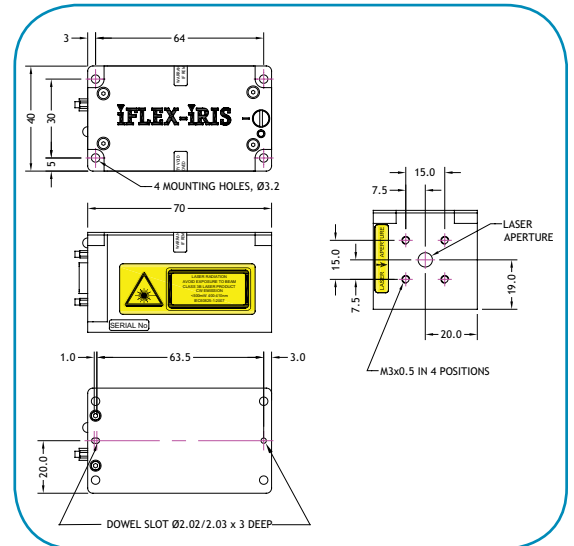


iFLEX-iRIS fiber coupled lasers

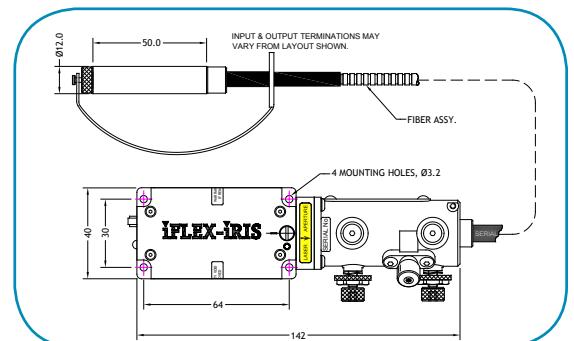
Wavelengths (nm) and Power after fiber (mW)																						
375	405	413	445	458	473	488	505	515	520	532	561	594	633	637	642	647	660	670	730	780	830	852
25	30	50	20	45	50	20	30	40	20	25	25	12	20	65	20	30	50	6	10	45	65	20
30	50		50			50							45		65							
	100					90																
	130																					
	150																					

7

Wavelength (nm)	CLM, 375-520nm & 633-852nm	532	561	594
Spatial mode, TEM00	M2 < 1.2 typ			
Beam Ø at 1/e2	0.7 ± 0.2 mm			
Pointing stability	< 5 µrad/°C			
Polarization ratio	≥ 200:1, Vertical ± 2o			
Power supply	12V DC, 1A			
Base plate temp.	40 °C maximum			
Heat dissipation	12 W maximum, < 5W typical			
Operation modes	CW / Modulated: Analogue, Digital, Dual Input / Software	CW		
Power stability, 8 hrs	< 0.5 %	< 2 %		
RMS noise (20Hz - 20MHz)	< 0.05* %	< 0.3* %, <0.1% 561nm		
Peak-Peak noise (20Hz to 1MHz)	< 0.5* %	< 3* %		
Max Periodic noise spike (1KHz -1MHz)	< 0.05* %	<0.3*%, <0.1% 561nm		
CW, power adjust	0%, 0.1 - 100%	Off, 50-100%, and 561nm Off, 15-100%		
Digital Modulation	Digital signal Bandwidth DC to 5 MHz Extinction ratio 1,000,000:1 Rise / fall time < 100 nsec	OEM options		
Analogue Modulation	0 - 5V signal Bandwidth DC to 5 MHz Extinction ratio 1,000,000:1 Rise / fall time < 100 nsec Power adjustment Off and 0.1-100%	OEM options		
Dual Mode Modulation	Two input ports for modulation Same specifications as above. Simultaneous input signals for a) Digital fast On/Off, and b) Analogue power adjustment via external 0-5V input or internal software setting.	OEM options		
Communication	micro-USB, RS232	OEM options		
Laser only	70(L) x 40(W) x 38(H) mm			



iFLEX iRIS Laser



iFLEX iRIS Fiber Coupled Laser

iFLEX-Gemini Dual-Wavelength Laser Engine Series

The iFLEX-Gemini™ is a series of solid-state 2-line laser engines providing a combined, co-axial output beam from one compact unit. Robust design in the iFLEX-Gemini eliminates the need for user alignment of the internal laser sources.

It is a true turnkey system for OEM instrumentation and researchers.

Precision Control

Each laser is independently and directly controlled, instead of combining beams through an AOTF. This provides a faster response time. It enables instantaneous switching between wavelengths and simultaneous emission.

Automatic closed-loop control ensures excellent long-term power stability.



CDRH Compliance for End Users

The iFLEX-Gemini laser engine is CDRH compliant when used with its CDRH interlock power supply option.

Fiber Delivery

Fiber coupled versions of the iFLEX-Gemini are also offered. The user can also add or remove the fiber at any time to maximize flexibility for researchers.

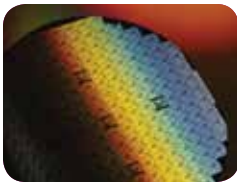
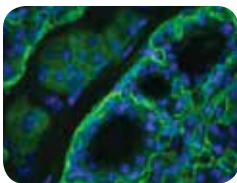
Features & Benefits

Features:

- Output: Combined, Co-axial
- Fully independent laser control
- True Off for each wavelength.
- Class leading power stability
- Ultra-low noise performance
- Class leading beam pointing stability
- OEM and End User options

Benefits:

- No laser alignment required
- Easy to use, portable, turnkey system
- Longer useful lifetime compared to traditional gas lasers
- x10 smaller than equivalent argon laser
- Direct modulation of each wavelength
- Reliable and repeatable measurements



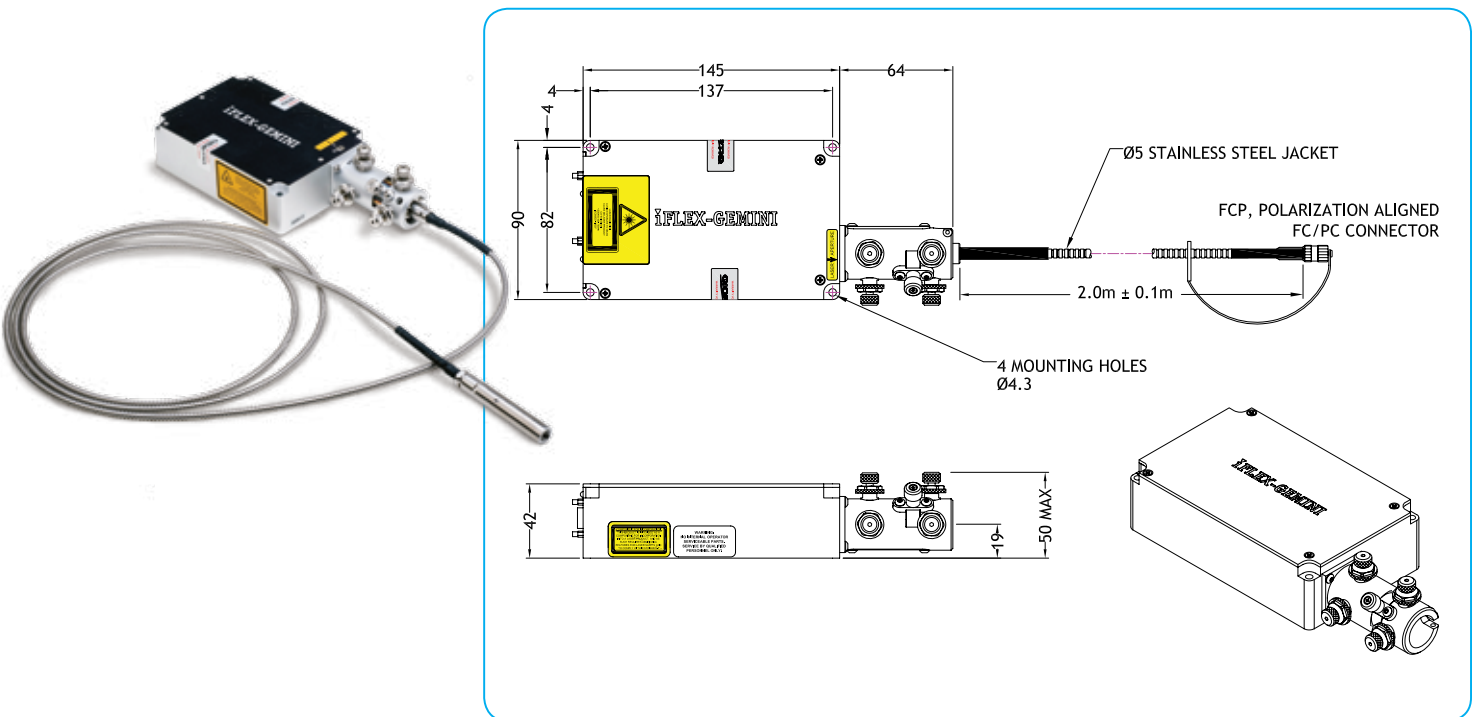
iFLEX-Gemini laser specification overview

iFLEX-Gemini™						
λ1/λ2	445	488	515	561	640	647
405	50/50	50/50	-	-	50/50	
445	-	-	50/50	-	-	-
488	-	-	50/50	50/30	50/50	
Direct laser power (mW). Standard λ pairs.						

Fiber coupled iFLEX-Gemini™						
(nm)	445	488	515	561	640	647
405	30/30	30/30	-	-	30/30	
445	-	-	30/30	-	-	-
488	-	-	30/30	30/20	30/30	
Fiber delivered power (mW). Standard λ pairs shown.						

Wavelength (nm)	405 ± 5	445 ± 5	488 ± 2	515 ± 2	561 ± 2	640 ± 5 or 647 ± 5
Noise (rms) 20Hz-2MHz	< 0.1* %		< 0.3* %			< 0.1* %
Power stability, 8 hrs	< 2 %					
Spatial mode, TEM ₀₀	M ² < 1.2 typical					
Laser output beam	0.7mm ± 0.2mm collimated diameter, collinear					
Standard fiber options	Type: SM PM fiber Length: 1m, 2m or 3m Output: Collimated Ø0.7mm beam or Connector FCP / APC / FCP8					
Pointing stability	< 1 µrad/°C after fiber output < 5 µrad/°C with direct beam (no fiber)					
Polarization ratio	≥ 100:1					
Max. base plate temp.	40 °C					
Max. heat dissipation	24 W, < 5W typical					
CW, Power adjustment	0%, 0.1 - 100%			0%, 50– 100%		0%, 0.1 - 100%
Digital Modulation Bandwidth Rise / fall time	TTL signal DC to 500 kHz < 1 µsec			OEM options		TTL signal DC to 500 kHz < 1 µsec
Analogue Modulation	On request					
Dimensions	130 (L) x 90 (W) x 38 (H) mm					

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iFLEX-Viper Multi-Wavelength Laser Engine Series

The iFLEX-Viper™ is a high-performance, solid-state, multi-wavelength laser engine providing up to 5 lasers in a single system with combined, co-axial output. Robust design eliminates the need for user alignment of the internal laser sources. It is portable and easy to use.

Precision Control

The power adjustment and modulation pattern for each laser is independently controlled; instead of combining beams through an AOTF and allowing the lasers to always emit. Fully independent laser control enables instantaneous switching between wavelengths and simultaneous emission of any wavelength combination. Lasers will only emit when requested, so lifetime may be extended.

Automatic closed loop control ensures excellent long-term power stability.

The iFLEX-Viper is compatible with a number of commercially available imaging software packages, such as, μ -Manager™ and LabView™.

Permanent Laser Alignment

Robust, novel, opto-mechanical design in the iFLEX-Viper eliminates the need for user alignment of the internal laser sources. It is a true turnkey system requiring only a drive signal per line to initiate laser emission. The ultra-stable design delivers reliable and repeatable measurements in all applications.



It is a true turnkey system for researchers, easily connected by fiber to microscopes and other instruments. Compact OEM versions also available

Fiber Delivery

The iFLEX-Viper is designed to fiber couple into the kineFLEX single-mode, polarization maintaining fiber delivery system. After the fiber output, the different wavelength beams remain co-axial, polarized and combined as they propagate through any other optics and onto the sample where they overlap. The kineFLEX fiber provides easy connection to microscopes and other analytical and biomedical instruments.

Laser performance is specified and guaranteed after the fiber. The kineFLEX SM PM fibers are offered in different lengths with either collimated or connector outputs.

Features & Benefits

Features:

- Output: Combined, Co-axial
- Fully independent laser control
- True Off for each wavelength
- Class leading power stability
- Class leading beam pointing stability
- Ultra-low noise performance
- Options: USB, Fibers, Future upgrades
- OEM or CDRH compliant systems

Benefits:

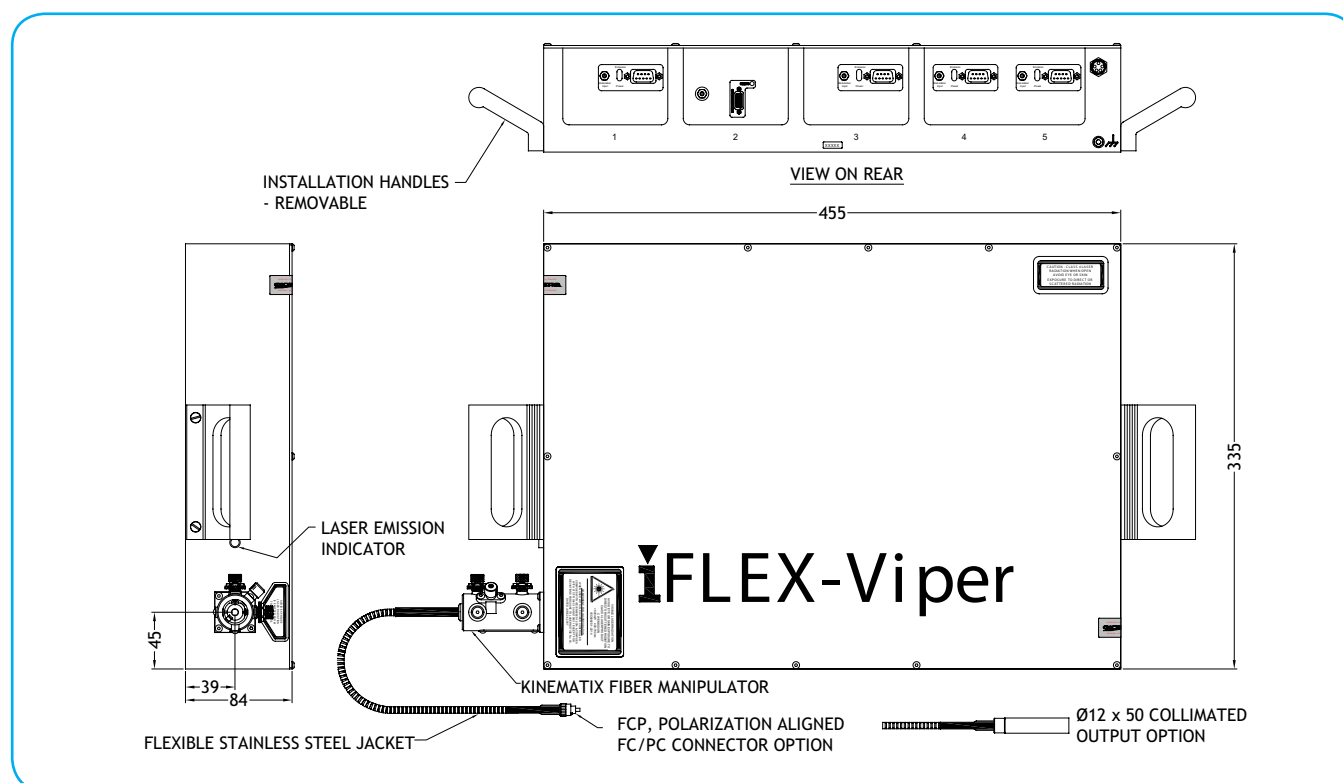
- Easy to use. Portable. Turnkey system
- No laser alignment required
- Reliable and repeatable measurements

iFLEX-Viper fiber coupled laser specification overview

Wavelength (nm)	640 ± 5		561 ± 2		532 ± 2		515 ± 2		488 ± 2		445 ± 5		405 ± 5	
Nomenclature	R		Y		G1		G		B		I		V	
Power after fiber (mW)	20	50	20	50	20	50	20	40	20	50	20	50	20	50
RYBV - Basic System														
Low power iFLEX-Viper-RYBV	•		•		◊		◊		•		◊		•	
High power iFLEX-Viper-RYBV		•		•		◊		◊		•		◊		•
YGBI - Basic System														
Low power iFLEX-Viper-YGBI	◊		•		◊		•		•		•		◊	
High Power iFLEX-Viper-YGBI		◊		•		◊		•		•		•		◊
Noise rms (20Hz – 2 MHz)	< 0.1% typ		< 0.3 % typ				< 0.1 % typ							
Power stability (8 hours)	< 2 %													
Spatial mode, TEM ₀₀ , M ²	M2 < 1.1 typ, diffraction limited													
Pointing stability after fiber	< 1 μrad/°C													
Polarization extinction ratio	≥ 100:1													
Max. base plate temp.	40 °C													
CW power adjustment (per λ) %	0, 0.1-100%		0, 0.1-100%		0, 0.1-100%		0, 0.1-100%		0, 0.1-100%		0, 0.1-100%		0, 0.1-100%	
Analogue Modulation (per λ)	0 – 5 V		0 – 5 V		0 – 5 V		0 – 5 V		0 – 5 V		0 – 5 V		0 – 5 V	
Bandwidth	DC to 2MHz, over 3dB bandwidth frequency													
Dynamic range	≥ 30 dB													
Rise / fall time over 10 – 90%	≤ 350 ns													
Dimensions laser head	455mm (L) x 335mm (W) x 84mm (H)													
Dimensions controller	370mm (L) x 322mm (W) x 85mm (H) (or H = 91mm with feet)													

◊ Options for 5th line. Other wavelength combinations are also available.
 ◊ Fiber output options: 1m, 2m or 3m lengths, 0.7mm diameter collimated or connectors (FCP, FCP8, APC)

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kineFLEX Fiber Delivery Systems

The kineFLEX® is a robust laser beam delivery system for precision measurement applications. Single-mode, polarization maintaining kineFLEX fiber delivery systems offer reliable delivery of laser light with the world's best beam pointing stability. Compatible with most lasers, the kineFLEX includes pre-focussed integrated collection optics optimised for the laser, and any required output beam shaping and the kineMATIX fiber coupler.

kineFLEX Fibers Can Be Coupled to Most Lasers:

Single λ : for diode, DPSS, gas etc.

White light λ : 488-640nm, ArKr, RGB systems

Broadband λ : 400-640nm, 488-780nm

ULTRA wide λ : 400-800nm

High Power: to 500mW standard or custom

Ultra-Violet λ : 355nm

Options

- Various wavelengths
- Various fiber lengths
- Various power levels
- Collimated or Connector outputs
- Custom OEM options



Reasons to use a kineFLEX Fiber Systems

- Easy beam delivery from "A" to "B"
- Remove hot spots / side lobes / irregularities in the beam profile as the fiber acts as a spatial filter
- Minimize beam jitter to $< 1 \mu\text{rad} / ^\circ\text{C}$
- Higher power throughput levels
- Easier instrument production & servicing with detachable fiber delivery
- Reduce optical errors from multiple interfaces with integrated beam shaping
- Improve instrument stability by removing risk of bulk optic movement through integrating beam shaping optics in fiber
- Safely enclose laser beam
- Compatible with different environments such as vacuum, UHC, dusty, vibrating
- Custom beam shaping integrated in fiber



OEM options for beam shaping, collection & in-fiber combiners. World leading beam pointing stability at $< 1 \mu\text{rad}/\text{Co}$, provides minimised jitter for higher resolution images.

kineMATIX Fiber Coupler

The kineMATIX® is the patented opto-mechanical mount used to align the laser beam into the single-mode fiber.

It has 4-axes of adjustment (X, Y, tip, tilt) and a centrally located fifth button for easy removal and insertion of the fiber. The design provides sub-micron repeatability and sub-microradian stability. This robust and thermally insensitive design enables the kineMATIX to maintain laser-to-fiber alignment across a wide temperature range and during transit. It truly offers "Set & Forget" laser to fiber alignment.

A kineMATIX Coupler is included with the kineFLEX Fiber Delivery Systems.

For over 25 years, the kineMATIX has given our customers the confidence to use detachable, modular fiber systems inside instruments and in precision experiments. It is the only fiber coupler to offer "Plug & Play" performance, since the alignment is retained when the fiber is removed and remains when the fiber is re-inserted.



OEM Expertise and Capabilities

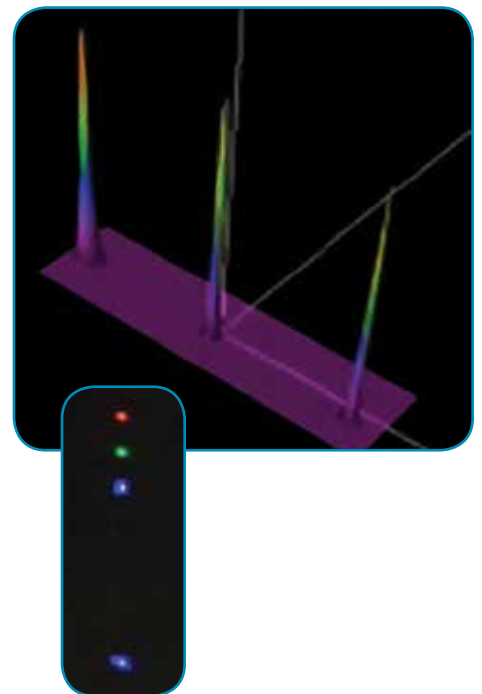
Qioptiq is happy to work with our customers to ensure that each fiber system, laser system or laser engine is optimal for the application, and so we offer custom OEM solutions.

An example of these OEM solutions are the iFLEX-HYDRA™ laser engine systems. These are custom designed multi-wavelength laser engines, with integrated beam shaping on the fiber output to produce spatially separated beams. These systems effectively combine all the wavelengths needed within the smallest dimensions, and with a fiber output generating the required beam spot pattern in the flow cell or sample. They can also be paired with a collection fiber array to maintain the smallest possible beam paths.






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Engage Flexible Laser Technology™ and true development partnership

With over 25 years supporting demanding applications in industrial manufacturing, biotechnology, clinical diagnostics and semicon, Qioptiq brings design and manufacturing expertise in lasers, fiber optics and multi-line laser engines to every partnership.



The iFLEX[®] Spectrum

Standard Maximum Output Power(mW)					
Wavelength (nm)	iFLEX-iRIS Laser 	iFLEX-iRIS Fiber Coupled Laser 	iFLEX-Gemini Laser Engine 	iFLEX-Gemini Fiber Coupled Laser Engine 	iFLEX-Viper Fiber Coupled Laser Engine 
375	50	30			
405	220	150	50	30	50
413	100	60			
445	75	50	50	30	50
458	70	45	50	30	
473	75	50			
488	140	90	50	30	50
505	50	30			
515	60	40	50	30	40
520	30	20			
532	40	25			50
561	40	25	30	20	50
594	20	12			
633	70	45			
637	100	65			
642	100	65	50	30	50
647	50	30	50	30	
660	80	50			
670	10	6			
730	20	10			
780	70	45			
830	100	65			
852	35	20			

Measured at laser beam exit or after fiber output for fiber coupled laser systems.



Discover the Q!

Qioptiq delivers cutting-edge technology for all photonic and optical requirements of OEM System development and scientific research alike. Global production capabilities and state-of-the-art manufacturing guarantee an impressive portfolio of products and solutions. Discover the Q for high-performance solid-state laser systems and fiber optics.

Photonics for Innovation

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