

# SuperK EXTREME

## High Power Supercontinuum fiber laser series

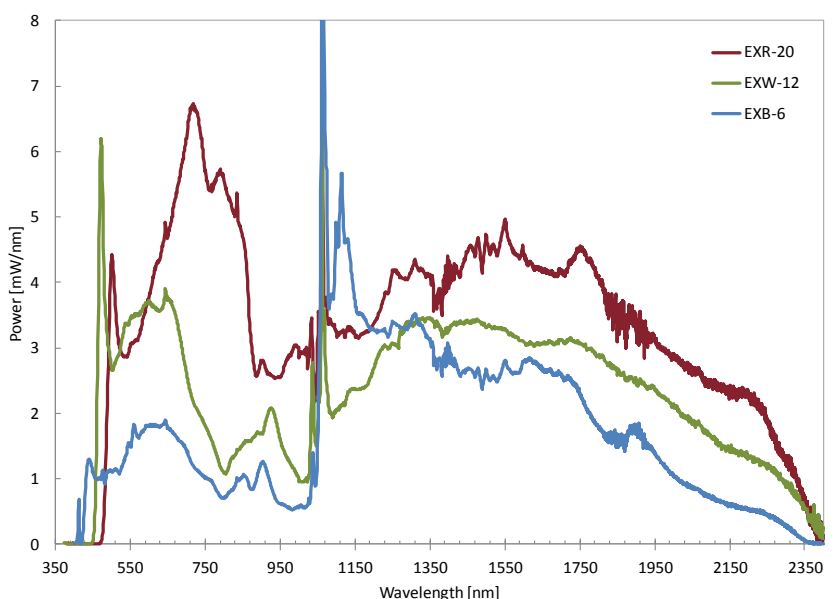
- 400-2400nm single mode spectrum
- Unsurpassed reliability and lifetime
- On-the-fly variable repetition rate
- Plug'n'Play filter accessories
- Flexible trigger and power locking functions
- Operation at the press of a button
- Light on-demand within 20ms
- NIM trigger output approved for FLIM



SuperK supercontinuum sources delivers a wide spectral output covering hundreds of nanometers while keeping the high brightness and mode quality known from single line lasers. Our lasers are fully fiber monolithic ensuring excellent reliability — completely alignment and maintenance free.

The SuperK EXTREME series is based on NKT Photonics world renowned Crystal Fibre technology that has reliably delivered supercontinuum to all fields for over 10 years. The SuperK platform is fully modular, allowing easy operation and service where accessory modules can be added without configuration—all plug&play. Operation is simple and functions can be changed on-the-fly without powering down the system. The SuperK EXTREME series provides high power and exceptional lifetime together with the highest of safety standards.

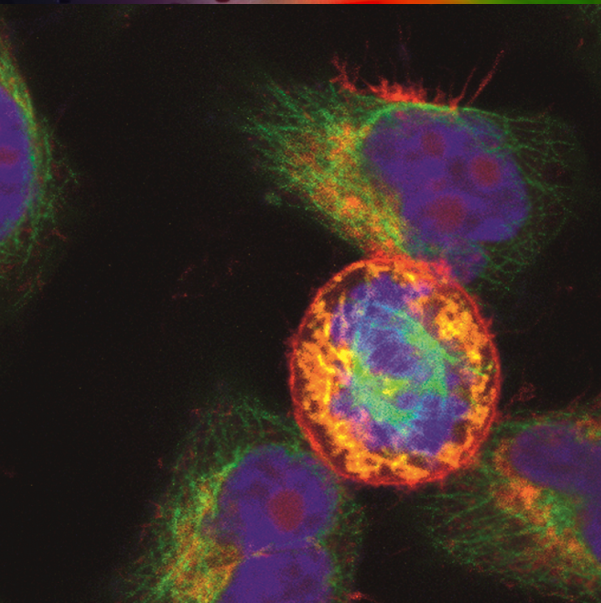
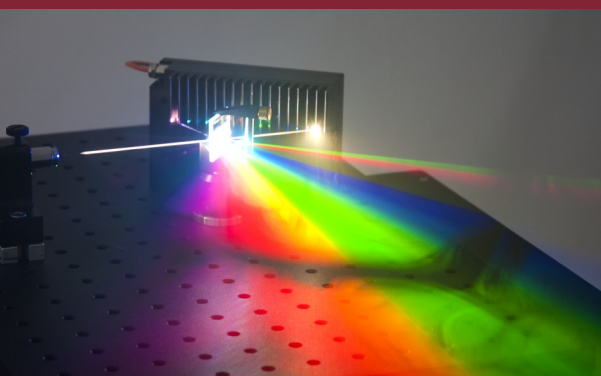
The SuperControl graphic user interface ensures that users from any discipline finds the SuperK EXTREME an easy tool to use.



Blue (EXB), White (EXW) and Red (EXR) systems provide users with a comprehensive coverage of the supercontinuum spectrum with power levels from 1.5W to over 8W.

## Applications

- Microscopy
- Fluorescence Lifetime Imaging
- Optical Coherence Tomography
- Spectroscopy
- White light interferometry
- Plasmonics & meta materials

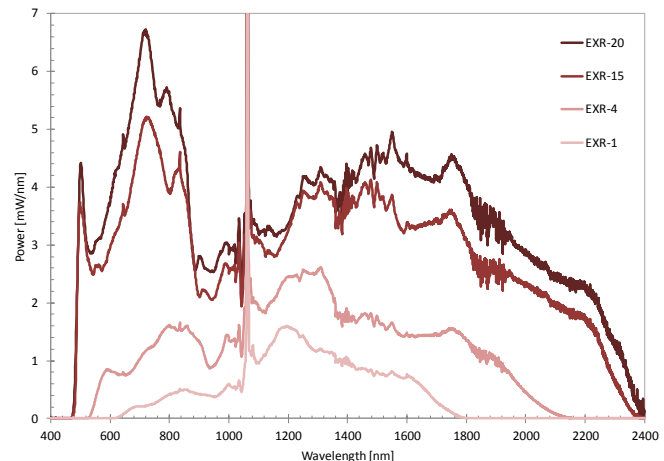
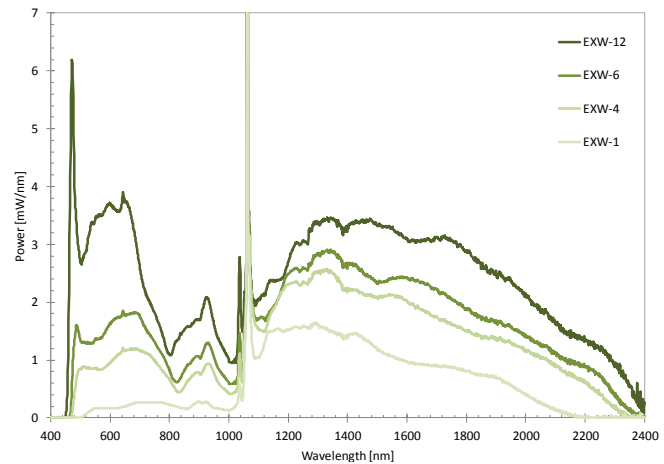
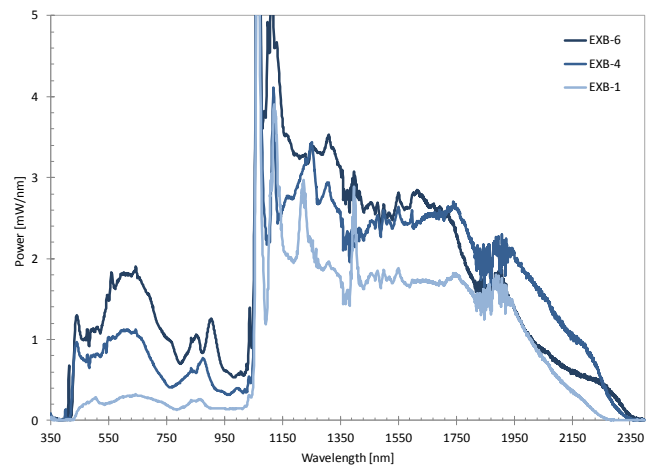


## Spectral coverage

The SuperK EXTREME is available in three different variants:

- Blue EXB series
- White EXW series
- Red EXR series

Choose the EXB series if you need short blue wavelengths down to 400nm. The EXW series is a great all-around source providing good coverage of the visible spectrum while offering higher power than the blue EXB series. The red EXR series are for those who need serious power or applications where the shortest wavelengths are not important. The EXR series is our most popular model for high resolution OCT— typically in combination with a [SuperK GAUSS filter](#).



EXB series	EXW series	EXR series	Visible power* (350-850nm)	Typical total power
EXB-1	EXW-1	EXR-1	100 mW	1W
EXB-4	EXW-4	EXR-4	400 mW	2.4W
EXB-6	EXW-6	-	600 mW	3W
-	EXW-12	-	1200 mW	4.5W
-	-	EXR-15	1500 mW	6W
-	-	EXR-20	2000 mW	8W

\* SuperK EXTREME has the industry's highest visible to total power ratio yielding more visible power at a given total power level. For a thorough description of optical power measurement, see our [application note](#) on [www.nktp Photonics.com/superk\\_extreme\\_support](http://www.nktp Photonics.com/superk_extreme_support).

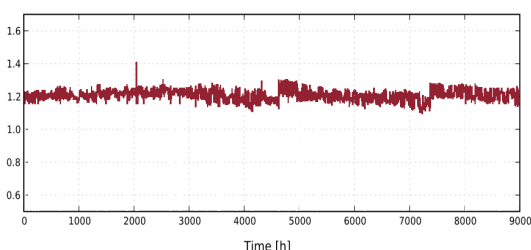
## Support and Warranty

### SuperK CARE support/warranty

All SuperK EXTREME products comes with industry leading reliability and are backed by our standard 2 year warranty. However, should you need the extra security of an extended warranty and remote diagnostics support this is available in our SuperK CARE support and warranty extension package. Please contact your sales representative for more information.

### Lifetime

Systems exhibiting over 10,000 hours of continuous lifetime underlines the high reliability of NKT Photonics Crystal Fibre technology. High power systems delivering 8W of total power with 2W of visible power emphasize the high ratio of visible to total power of SuperK EXTREME systems. This efficient generation of visible supercontinuum reinforces the high lifetime performance of the SuperK EXTREME Series.



## Options

- Blue (EXB), White (EXW) or Red (EXR) spectrum
- 1.5-8W total power
- 100mW-2W visible power
- Master repetition rate 40 MHz or 78 MHz
- On-the-fly variable repetition rate (pulse picker)
- Software Development Kit (SDK)
- 12 and 24 months warranty extension packages
- Power Lock external power locking functionality

## Power Lock specifications

Typical power stability*	< ± 0.5 %
Modulation input voltage	0 – 10V
Current mode	
Modulation bandwidth, 3dB	100Hz (typ)
Rise- and falltime	<5ms (typ)
Power mode	
Modulation bandwidth, 3dB	50Hz (typ)
Rise- and falltime	<10ms (typ)
Feedback input voltage	0 – 4V
Feedback bandwidth	<200Hz
Feedback sample rate	200Hz

\*Depending on setup and wavelength range

## Software

### SuperKontrol control software

The SuperKontrol GUI is an easy to use, intuitive interface allowing the user to control all features of the SuperK system via a standard PC through one single interface. The SuperKontrol GUI mimics the front panel controls of the SuperK system and contains different control screens to reflect the different functions and accessories that are connected to the SuperK. An overview screen informs the customer of the status of the SuperK and allows the user to toggle through all attached accessories.

### Software Development Kit (SDK)

The SuperK EXTREME software development kit (SDK) enables control of the SuperK laser using third party software and hardware. The SDK contains a full description of the communication protocols as well as LabView drivers and C++/C# source code.

## Features and Options

### Power Lock (external power locking)

The Power Lock options enables you to lock the power at any place in a setup. Simply place a photo detector at the desired location and connect the detector to the External Feedback BNC connector of the SuperK. Activate locking from the control panel and the SuperK will now lock the power level at the position of the photo detector—automatically compensating for any drift or variation in external components in the setup up to 200 Hz.

Most of our SuperK accessories are also available with a build-in Power Lock monitor for ultra stable output (typically < ± 0.5 %). See more in our [application note](http://www.nktphotonics.com/superk_extreme_support) at [www.nktphotonics.com/superk\\_extreme\\_support](http://www.nktphotonics.com/superk_extreme_support).

### Variable repetition rate (pulse picker)

The pulse picker option allows the repetition rate of the SuperK EXTREME to be easily changed on-the-fly while the system is running at full output. Repetition rates of 1-40MHz or 2-78MHz are available as standard (down to 100 kHz on custom request), giving the user ultimate choice for lifetime measurement applications such as FLIM.

For more information on how to use the SuperK EXTREME for FLIM see e.g. Leica Microsystems SP8X confocal microscope.

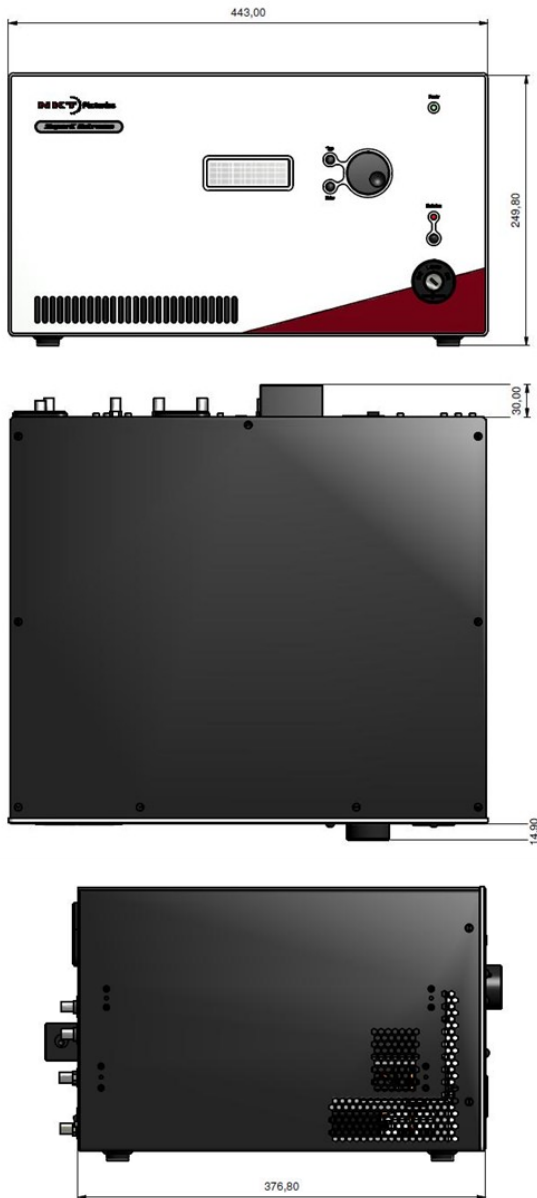
- Ideal for FLIM, FRET and diffuse optical tomography
- 1-78MHz on-the-fly variable repetition rate with 40 steps
- > 1:10,000 Pulse Suppression ratio
- NIM standard trigger output (directly usable for FLIM)
- Timing delay generator

Master Seed Repetition Rate	78 (standard) or 40 MHz
Repetition Rate Reduction	78 – 2 MHz (40 steps)
	40 – 1 MHz (40 steps)
Pulse Suppression Ratio	> 1:10,000
Operation Mode	Constant Pulse Energy
Changing Repetition Rate <sup>1)</sup>	< 1 s
Timing Trigger Output Jitter	< 20 ps
NIM Trigger Output (BNC)	0.1 – 1 V peak
Monitor Trigger Output (BNC)	0 – 1 V
Gate Trigger Output (BNC)	0 – 1 V
Delay Shift between Pulse Picker Ratio <sup>2)</sup>	< ± 250 ps
Adjustable Trigger Delay Timing <sup>3)</sup>	up to 9.2 ns
Adjustable Trigger Delay Resolution <sup>3)</sup>	15 ps

1) The system does not need to be electrically shut down.

2) The maximum change in delay between optical and electrical pulse relative to the delay at 78MHz.

3) The electrical output trigger signal can be delayed up to 9.2 ns in steps of 15 ps. This enables trigger delay optimization without the need for a expensive delay box. Adjustable from front panel.



## Specifications

### Optical

Master Rep Rate	40MHz or 78 MHz
Master seed laser pulse	~5ps
Total visible power stability	+/-1.5% (without Power Lock)
Polarization	Unpolarized
Beam output	Gaussian, single mode
$M^2$	< 1.1
Output options	Collimated or divergent output
Length of output fiber	1.5m
Beam diameter	~1mm at 530nm ~2mm at 1100nm ~3mm at 2000nm
Beam Divergence (half angle)	< 5mrad
Beam Pointing Accuracy <sup>1)</sup>	< 1mrad
Beam Pointing Stability	< 50 $\mu$ rad
Single mode fiber coupling efficiency	>72%
Analog Master Seed Trigger Output (BNC)	0 – 3.3V

### Mechanical/Electrical

Computer Interface	USB 2.0
Operation Voltage	100-240 VAC 50/60 Hz
Power Consumption	<100W (<120W with pulse picker)
Door Interlock Connector <sup>2)</sup>	2-pin LEMO
External Bus interface <sup>3)</sup>	16-pin sub-D
System Cooling	Air Cooled
Operation Temperature	+18° to +30°C
Storage Temperature	-10° to +60°C
Dimensions (WxHxL)	440x243x380mm <sup>3</sup>
Weight	18kg (19kg with pulse picker)

- 1) Measured relative to the mechanical axis running through the center of the collimator
- 2) The SuperK Extreme is a Class 4 laser and is required to be connected to a door interlock/circuit
- 3) External communication and power supply port for accessories



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All NKT Photonics products are produced under our quality management system certified in accordance with the ISO 9001:2008 standard.



## Light Manipulation Accessories

### SuperK VARIA

SuperK VARIA is a cost effective and flexible alternative to a monochromator, effectively turning the SuperK supercontinuum white light source into a powerful single-line laser with a 420 nm tuning range and variable bandwidth. The center wavelength of the pass band can be tuned anywhere between 400 and 820 nm and the bandwidth is variable between 2 and 100 nm, making the SuperK VARIA the most flexible filter solution on the market. Increasing the bandwidth of the filter has the added advantages of higher power throughput and reduced speckle in imaging applications. Moreover, a high out-of-band suppression of up to 50dB makes the SuperK VARIA an ideal tool for FLIM and other applications using high sensitivity detectors.

### SuperK SELECT

SuperK SELECT is a tunable wavelength filter based on acousto-optic tunable filter technology (AOTF). AOTFs tune over one octave of optical frequency and the SuperK SELECT allows the integration of two AOTF crystals to provide wide spectral coverage. Together with a range of unique features, the SuperK SELECT provides an easy to use, flexible and accurate tuning accessory to access any wavelength in the SuperK spectrum.

### SuperK GAUSS

SuperK GAUSS is a dual-output filter that transforms the wide spectral bandwidth of the SuperK EXTREME and provides a Gaussian-like spectrum.

For OCT, the SuperK GAUSS provides two high power spectral outputs centred at 800nm and 1300nm, with bandwidths of up to 200nm. Similar configurations are also available for WLI applications. The two Gaussian shaped spectra can be used simultaneously but independent from each other due to its unique design. The SuperK GAUSS even allows tuning of the center wavelength of each band over 200nm.

### SuperK SPLIT

SuperK SPLIT allows the SuperK spectrum to be divided into two spectral outputs. In its standard form, the SuperK SPLIT provides two outputs: Visible and nIR. However, the choice of the split in the spectrum can be user-defined to be anywhere in the SuperK spectrum. Additionally, standard mounts within the SPLIT allow the insertion of narrow band filters, polarisers or attenuators at each output exit for further flexibility.

### SuperK CONNECT

SuperK CONNECT is a high performance fiber delivery system complete with broadband fibers and a range of termination options such as FC/PC connectors or collimators. Interfacing is handled by the CONNECT fiber coupling unit that ensure easy and stable single-mode coupling that can be disconnected and reconnected without alignment.

